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ABSTRACT

The papers contained in this document cover the following topics related to preservice teacher education and technology: an initiative to improve technology education in Michigan; computer technology courses; uses of information technologies in an Australian degree program; use of an electronic bulletin board; discovering South Dakota through telecollaborative means; teachers and students collaborate to master technology curriculums; four-year collaborative for preparing teachers to use technology; creating partnerships that renew preservice education; teaching the use of information in a technology framework; developing a cross-curricular focus to information and communication technology teaching; pairing up inservice and preservice teachers to develop an understanding of technology integration; infusing technology into the curriculum; preparing teachers for the digital age; increasing instructional technology competencies; creating a dynamic model for educational technology in a field-based program; preparing teachers to integrate technology; technology integration in colleges of education; an innovative strategy for supporting teachers during field experiences; technology as a tool; teachers as constructivist producers and critical consumers of technological resources; learning practices in Amsterdam; the evolution of a hands-on technology integration course; an innovative course including the integration of information and communications technology; an educational paradigm for tomorrow's society; preliminary investigation of influences on student teachers' self-efficacy for teaching with computers; preservice teachers' beliefs about effective uses of computers in the classroom; flexible delivery of teacher professional development for information technology; how computer-based visual mapping tools can enhance learning; integrating technology for moral education in the student teaching practicum; preparation for the integration and implementation of appropriate technology; electronic portfolios for learning and assessment; development of a personal electronic profile; preparing teachers for constructivist classrooms; computer-mediated communication; using group process techniques to facilitate development of technology skills; enriching field experience through e-mail mentoring; integrating technology into inquiry-based teacher education; teachers learning about software implementation; implementing mandated information technology infusion; six categories of technology

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practice; a multimedia CD-ROM; using videos of technology-using teachers to enhance technology skills; using videotape technology to enhance the transformation into practicing teachers; lessons from a K-12/university collaborative; preservice teachers as models; a collaborative technology partnership; a new paradigm of teacher education integrating technology; using technology in field experience in regular and special education; meeting National Council of Accreditation for Teacher Education standards; using the Internet to promote technology integration, thinking skills, and motivation; advancement of technology integration skills through university coursework; and giving teachers the tools they need to integrate technology. (Contains 384 references.) (MES)

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PRESERVICE TEACHER EDUCATION

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Three major themes emerge from the papers presented this year for preservice teacher education: collaboration, modeling, and the modeling of collaboration. Collaboration aimed at changing teacher education is taking place among many individuals and groups. Working under the premise that teachers teach as they are taught, teacher educators are modeling effective use of technology in preservice teacher classes. Ultimately, collaboration itself is being modeled to preservice teachers as one of the best ways to bring about major changes in education processes. These three major themes cut across all the domains of teacher education — how interesting! What does that say about the state of Information Technology in Teacher Education as we approach the new millennium?

Collaboration In Teacher Education

Collaboration to make improvements in preservice teacher technology education is taking place at many levels. McManus (Saginaw Valley State University), Charles (Eastern Michigan University), and Rubio (Albion College) describe the Consortium for Outstanding Achievement in Teaching with Technology (COATT), a collaborative effort by ten Michigan colleges and universities. Brown (Washington State University), Appleman (Indiana University), Green (California State University) and Hansen (University of Northern Iowa) compare the goals and activities of the Educational Technology classes at their four separate universities. The courses share as a goal the improvement of the learner's ability to use computing tools in education, but the activities employed to achieve this goal vary. In this same descriptive genre, Chambers and Tromp (University of Melbourne, Australia) outline the development of Instructional Technology (IT) skills as primary (elementary) education students progress in their course work. This development includes both generic IT skills and IT skills specifically related to curriculum areas. LaMaster (San Diego State University) and Morely (Northern State University) have designed a collaborative project between their universities using an electronic bulletin board to provide an opportunity for students to interact concerning pedagogical and professional issues. Seed (Northern Kentucky University) examines a collaborative effort involving interview and e-mail exchanges employed to gather information for evaluation of a collaborative learning environment involving faculty from the Colleges of Education and Arts & Sciences in a chemistry course for elementary and middle school preservice teachers. Peterson (South Dakota State University) focuses on the Discover South Dakota Tellecollaborative Project. This project has been used as an integral part of the curriculum in the required preservice technology class, involving future teachers in an opportunity to experience technology integration in the curriculum.

Collaboratives involving field experiences include the Fifth Dimension experience reported by Zimmerman and Greene (Appalachian State University). Preservice students participated in an after-school program in the enhanced learning environment of the Fifth Dimension center, where children were offered opportunities to experiment with educational software and other technology equipment. Morgan (Minnesota State University–Bemidji) describes a project based on a collaborative model which includes the preservice teacher, faculty supervisor, classroom mentor and school based technology coordinator. In this model, the preservice teacher has the opportunity to check out equipment and software based on a written instructional plan for the integration of the resources into a field based classroom lesson.

There are collaboratives among faculty, successful inservice teachers, and preservice teachers. For example, Dempsey, Sutton, Gallagher, and Steckleberg (University of Nebraska) describe the Scholarship, Technology, and Educational Practice (STEP) program, in which K-12 master teachers team with methods faculty to develop and model ways to integrate technology effectively. Cheeks and Liu (Towson University) describe an information centered technology course for preservice teachers in which students

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collaborate with faculty to design projects that would be useful while giving them needed technology skills.

Selinger (University of Warwick, Coventry, UK) describes a project that placed preservice teachers of information and communications technology (ICT) into secondary schools, each in a particular subject area, to develop ways that ICT could be integrated across the curriculum. Preservice teachers benefited, as did inservice teachers, who were often lacking in ICT skills. Other projects involving the use of preservice ICT teachers are not always this successful, but it is expected that the cross-curriculum emphasis will be continued in the UK. Nocente (University of Alberta, Canada) describes a course for both preservice and inservice teachers. The course allows interaction between the two groups as they work on course assignments. Nocente found that inservice teachers who are vocal in their opposition to constructivist teaching can affect preservice teachers.

The goal of several multi-faceted collaborative efforts is to integrate technology into K-12 education by integrating technology into preservice teacher education. Carlson, Clark, Hosticka, Kostin and Schriver (Georgia Southern University) provide a summary of the progress made to date on collaboration involving the University and local school districts. Needs assessment results and establishment of a website and workshops for participants are presented. Future plans include further collaboration and evaluation. Dudt, Yost, and Brzycki (Indiana University of Pennsylvania) describe a consortium of three public universities that seeks the infusion of technology into teacher education programs. Couros (University of Regina, Saskatchewan, Canada) describes the vision and struggles of a college of education. Key participants in collaborative efforts include faculty, administration, library services, the technology committee and technicians of the college of education. Plans are being made for university collaboration with industry, telecommunications providers, and government education facilities. Snider, Gershner, Foster, and Huestis (Texas Woman's University) present a teacher education program called Learning and Integrating New Knowledge and Skills (LINKS) in which teacher educators, preservice teachers, and mentors collaborate to document the acquisition of technology competencies through each phase of teacher education. The Wyoming Capacity Building Project is a collaborative involving the University of Wyoming, the Wyoming State Department of Education, and seven community colleges. According to Westoff (University of Wyoming), the goal of this project is to build a technology enhanced teacher education program that will model effective infusion of technology for future teachers.

Garcia (University of Wisconsin Oshkosh) describes the assessment and planning groundwork laid for a major collaborative involving teacher educators, practicing teachers, and preservice teachers. The grant-funded project will enhance teacher education by modeling integration of technology into undergraduate instruction. Morgan (Minnesota State University–Bemidji) reports on a Federal TP3 Implementation Grant project, Class Act Preparing Tomorrow's teachers to use Technology. The Class Act program augments a four-year competency based, technology focused teacher preparation program, a collaborative among two universities, a community college, school districts and a private foundation.

Modeling Effective Use of Technology in Teacher Education

Teachers often teach in the manner they were taught. To ensure that preservice teachers become competent users of technology in their classrooms, universities are incorporating the use of appropriate technologies in their teacher education courses. Burkhouse and Ruthkosky (Marywood University) call for the infusion of technology in the curriculum as a tool, not a toy or a trophy. They call for the use of technology by teacher educators as a model in the academic community. Merideth and Steinbrom (Drake University) outline a constructivist approach to learning and work for preservice teachers as producers and consumers of technological resources. This approach utilizes FileMaker Pro database customized to gather test, graphics, sound, video, and references from the Internet. The information stored in the database is then used to create lesson activities for K-12 classrooms. Terwindt (Amsterdam Faculty of Education, Netherlands) describes a constructivist professional education program, "the experimental teacher education in the Netherlands" in 1997. Willis and Tucker (Northern Arizona University) describe a constructivist approach with their description of the "Multimedia Content Development Company." Teams of students complete content-centered projects that integrate technology tools in the presentation of topic.

Teacher education programs in the Netherlands are attempting to provide a foundation in the integration of ICT. The EXPLO project is one of these innovative attempts. Westhoek (Ichthus Faculty of Education, Netherlands) reports that this program is related to the Dutch government's Prommit program, based on the learn-as-you-work concept. He further outlines this project as he describes the Producing Student's role in learn-as-you-work and work-as-you-learn paradigms.

Teacher education programs vary in their ability to provide strong programs of instructional technology. Duran (Ohio University) surveyed three groups of preservice teachers in one college of education and found they felt ill-prepared to proceed with technology integration in their own classrooms. Albion (University of Southern Queensland, Australia) examines the influence of problem-based learning and multimedia methodology as a means of increasing preservice teachers' feelings of self-efficacy for teaching with computers. Hargrave and Sadera (Iowa State University) found that, prior to their teacher education program, preservice teachers hold naïve ideas concerning effective use of technology in the classroom. Student teacher views support traditional teaching methods. The authors conclude that teacher educators must find effective ways to give preservice teachers more comprehensive views of technology in their educational process. Watson (Griffith University, Australia) points to students' expression of the greatest satisfaction with the IT course when it includes adequate human and technological support accompanied by online resource material.

When preservice students experience the effects of new technologies they will be inclined to use them in the classroom. A course described by Brown and Ferry (University of Wollongong, Australia) incorporates concept mapping into preservice training for teachers of science and visual arts. Since the students found that constructing concept maps was helpful in their own learning, it is expected that they will continue to use this tool and incorporate concept mapping into instruction they design for their own future students. Reynolds (University of Wyoming) and Reynolds (Rock River School, Wyoming) have developed a program integrating moral education in the student teaching practicum, using technology as a delivery tool to facilitate student project development. Wilkerson (Baylor University) presents a triad (communication, productivity, and research/instruction) model of technology infusion in the classroom. This triad model is one approach to designing curriculum and experiences in a teacher preparation program.

Higher order thinking skills are used in the creation of electronic portfolios of preservice teacher's accomplishments used for assessment of progress. Morris and Buckland (University of Vermont) report on the use of these portfolios and the evidence that using hypertext and multimedia tools to create these presentations enhances technology skills. Ehli and Sorknes (Northern State University) also report on this method of skill enhancement. These portfolios were used to communicate a personal profile to mentor teachers, K-12 students, and future employers.

McGrew-Zoubi and Hirtle (Sam Houston State University) describe a series of courses and a summer camp that provided field experience for preservice teachers. Both the courses and the summer camp used technology in a variety of ways that required the preservice students to utilize technology in their learning. Further, constructivist methods were used in several instances, putting the students in situations that resembled the learning environment of their future students. Cooper and Hirtle (Sam Houston State University) describe the use of computer message boards during a field experience portion of preservice training and concluded that such computer-mediated communications systems offer valuable means of connection for faculty and students.

Hagen (University of Nebraska) points out that while the use of technology for learning is often a solitary process, teachers and students like to interact. Therefore, group learning appears to be appropriate for preservice teachers as they acquire technology skills. Wentworth, Monroe, Orme, and Lynes (Brigham Young University) used e-mail as a tool to encourage students to reflect on their observations and link their field experiences to theories learned in the university setting.

Jacobsen and Clark (University of Calgary, Canada) describe the steps being made to integrate mandated technology curriculum into an inquiry-based teacher education program. Through a series of technology training workshops, preservice teachers are given tools they will incorporate into their future classrooms. Pan (The College of New Jersey) stresses the importance of teaching preservice teachers to integrate technology correctly into curriculum. He describes a study in which preservice teachers observed elementary students as they explored Microsoft's Magic Bus software. Maushak, Lincecum, and Martin (Texas Tech University) are developing a web site that will assist preservice teachers and teacher educators create and evaluate inquiry-based Internet assignments for K-12 students.

Teacher education programs experience difficulties in making technology transitions. Chiero, R. Bohlin, C. Bohlin, and Harris (California State University, Fresno), and Casey (CalState Fullerton Regional Center) describe the efforts of several teacher education programs to implement state mandated technology infusion. Norton (George Mason University) categorizes technology practices in teacher education classrooms. She identifies technology problems teacher educators face and gives examples of successful solutions.

Carter (Iowa State University) points out that teacher educators need models illustrating successful technology integration so that they can, in turn, model for their preservice students. She describes the development and evaluation of a CD-ROM titled *Videos in Technology Integration*, which features videos of teacher educators using technology in their preservice teacher classrooms. Andre, Schmidt, Nonis, Buck, and Hall (Iowa State University) describe the development of CD-based video clips and case histories demonstrating K-12 teachers using technology in real teaching situations. Staudt and Fuqua (University of the Incarnate Word) describe another use of the videotaping process to enhance teacher education. In this paper they describe the use of video as a self-evaluation tool for preservice teacher preparation. This videotaping program provides accurate data for prospective teachers to reflect and assess their progress toward mastery of state competencies.

Modeling Effective Collaboration

For preservice teachers, collaboration itself models effective ways to bring about major change in education processes. Often experienced teachers do not have time to acquire new technology integration skills and may be inclined to continue their traditional teaching patterns. Preservice teachers can observe classroom realities by working with practicing teachers. Hornung and Bronack describe a unique K-12/university collaborative that pairs preservice teachers with experienced inservice teachers. Preservice teachers observe and assist their mentor teachers a minimum of 20 hours. The pair decides on one area of established curriculum that would be enhanced by appropriate use of technology. The preservice teacher prepares and presents the technology-enhanced lesson. Both gain from the experience, and practicing classroom teachers gain new technology skills that otherwise may never have been used in their classroom.

In a similar program, according to Coe (Midwestern State University), preservice teachers model the integration of technology for mentor K-12 teachers. In this collaborative teacher education classes are taught in public school classrooms. Preservice teachers spend over 50 percent of their learning time in K-12 classrooms and they develop classroom technology enhancement and model its use for K-12 mentor teachers. Christie (Arizona State University West) points out that, in a K-12 school district/university collaborative, all participants learn: university faculty, K-12 teachers and students, and preservice teachers. She describes a partnership in which K-12 teachers and university faculty team-teach middle school students in university computer labs. Dobson (Bloomsburg University of Pennsylvania) reports on a collaborative project involving preservice teachers, inservice teachers, and university faculty. Future teachers were required to use their technology skills in partner schools K-12 classrooms by creating an electronic portfolio containing technology-based activities.

Anderson (Southeast Missouri State) and Anderson (Kenosha Unified School District) describe a grant funded program that provided computer equipment and software including assistive technologies for regular and special education students' use in their field placements. Preliminary results in the form of case studies present a sample of projected outcomes as a result of this study.

Gladhart, Carroll, and Ellsworth (Wichita State University) describe Project EXCITE, which is a major collaborative effort among teacher education faculty and students, student mentors, university technology staff, and faculty and students in K-12 partner schools. The goals of this grant funded project, Expanding our Curriculum Integration through Technology Education (EXCITE), include revising curriculum, training faculty to integrate technology, while meeting the new standards of The National Council for Accreditation of Teacher Education (NCATE). As Gladhart, Carroll, and Ellsworth concluded, "Developing fearless faculty is a lofty goal, but once faculty become leaders, their students will be empowered to be leaders and advocates for change in schools."

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COATT: A statewide initiative to improve pre-service technology education in Michigan

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Abstract

Like many other states, Michigan has recently instituted minimum technology standards for pre-service teachers. A diverse group of teacher preparation institutions in Michigan who believed there was a need to recognize those who reach a higher standard got together to form the Consortium for Outstanding Achievement in Teaching with Technology. The purpose of the Consortium is to set in place a formal process to recognize pre-service, and eventually in-service, teachers for going beyond the mandated standard. Here we discuss both the process of bringing the Consortium together and the progress of our students as they apply for the M-COATT certificate, the first of which will be awarded in the spring of 2000. At this writing our students are preparing their electronic portfolios to showcase their work integrating technology into their classroom teaching. By February our students will have nearly completed the first submissions to our Consortium.

The Origins of COATT

In June of 1999, representative of ten Michigan colleges and universities joined with Senator Carl Levin of Michigan to announce the formation of the Consortium for Outstanding Achievement in Teaching with Technology (COATT). The Consortium is the result of a yearlong effort begun by Levin that brought together diverse teacher preparation institutions to find a way to raise the standards for technology preparation given to pre-service teachers. Research 1 universities, regional comprehensive universities, and small liberal arts colleges are all members of this Consortium.

Each participating institution signed a letter outlining their responsibilities as members of COATT. The Consortium itself will be housed at the College of Education at Eastern Michigan University. The office at EMU will receive applications, organize evaluation teams, and generally administer the certification.

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Each participating teacher training institution will assist candidates with the application process. They will name a person to act as a point of contact within the institution for potential COATT candidates. They will promote COATT to potential candidates through flyers, and other communications. Participating institutions will also provide support for candidates seeking COATT certification, such as adequate and relevant learning opportunities in the application of educational technology, and resources for COATT applicants to produce, maintain, and gain access to their COATT digital portfolios.

In addition to their responsibilities to support COATT applicants, participating institutions will retain responsibility for seeing to the health of the consortium across the years. Faculty liaisons will participate in an annual review of the COATT standards and will develop policy with other core members of the COATT organization. Faculty and other qualified personnel from participating institutions will be involved in COATT evaluation teams.

Earning the M-COATT certificate

In the 1999-2000 academic year, COATT will begin awarding a certificate, the M-COATT, to pre-service teachers who demonstrate excellence in the use of technology to enhance student learning. This certificate will exist independently of both degree programs and the state certification process. It will allow educators to demonstrate their proficiency in this area and will help school administrators who make hiring decisions identify teachers who can be technology leaders in their schools. The certificate will also allow institutions of higher education to benchmark their achievements in teacher training in technology against an independent standard of excellence. Students attending COATT member institutions who wish to receive the consortium's certificate must submit a digital portfolio for review by a panel composed of representatives of two or more of COATT's participating institutions (other than the student's own institution).

The COATT Standard

The standards used to award the M-COATT certificate are based on the Michigan Department of Education's [MDE] Seventh Standard for Entry Level Teachers. The Seventh Standard states that all entry-level teachers will have "an ability to use information technology to enhance learning as well as enhance personal and professional productivity." The Standard is divided into seven proficiencies (Michigan Department of Education, 1997):

Entry level teachers will be able to:

a) Design, develop and implement activities that integrate information technology for a variety of student grouping strategies and diverse student populations.
b) Identify and apply resources for staying current in applications of information technology in education.
c) Demonstrate knowledge of multimedia, hypermedia, telecommunications, and distance learning to support teaching/learning.
d) Demonstrate knowledge about instructional management resources that assist in such activities as writing and updating curriculum; creating lesson plans and tests; and promoting, reinforcing, and organizing data regarding student performance.
e) Use information technologies to support student problem solving, data collection, information management, communications, presentations, and decision making including word processing, database management, spreadsheets, and graphic utilities.
f) Demonstrate appreciation of equity, ethical, legal, social, physical, and psychological issues concerning use of information technology.

g) Use information technology to enhance continuing professional development as an educator.

Currently, the State of Michigan asks all entry level teachers to demonstrate achievement at the "basic" level (2 on the MDE's 4 point scale) in four of the areas and at the "proficient" level (3 on the MDE's 4 point scale) on the other three areas.. We expect the M-COATT standards to set a "higher bar" toward which entry level teachers may aim. To be awarded the COATT certificate, candidates will need to demonstrate achievement at the highest level (4 on the MDE's 4-point scale) on at least three of the seven components. At least two of the three components must be from among those components most closely linked to enhanced student learning: 7a, 7c, and 7e.

The Evaluation Process

As mentioned above, all candidates for the COATT certificate will be required to submit a digital portfolio for evaluation. The Consortium found itself faced with the question of just what does a quality portfolio look like? Initially participants in the Consortium offered anecdotal ideas of what they thought would qualify as "M-COATT certified," but actual sample portfolios had not been prepared at the onset of our discussions. The challenge of getting educational technology faculty from diverse institutions to agree on such a standard with the knowledge that a third party would independently evaluate their student's work was formidable. Eventually a rubric was proposed and agreed upon.

A portfolio is a focused presentation to a prospective employer of one's professional knowledge, experiences, and abilities. A student teacher selects important artifacts, the very best and clearest evidences of their growth and learning, to include in a portfolio. Such artifacts can include: a resume and philosophy of teaching; lesson plans and implementations of classroom activities; sample works of their own students; research papers and essays which they have written; video of their classroom teaching; evaluations and letters of commendation about their aptitude with pedagogy or content knowledge; anecdotal records about students or classroom management strategies; or awards of distinction. It is focused because specific skills and dispositions related to teaching are delineated; for example, one can include specific state or national standards for teacher preparation with corresponding evidence of mastery of those standards. Besides educators, professionals in other fields such as entertainment and the fine arts use portfolios. Doolittle (1994) and Campbell, Cignetti, Melenyzer, Nettles, & Wyman (1997) describe the basic outline of a traditional, or linear portfolio. The design of the portfolio should satisfy three sets of criteria that are not equally weighted:

- pedagogical; this is related to the quality of the teaching and learning that is presented and is accompanied by the students' reflections. It is very important to us that technical "style" not distract us from pedagogical substance.
- instructional; having said that, we do value style quite a bit. Components of the portfolio such as navigation and aesthetics make an important statement about the student's ownership of their technological skills. The portfolio should be structured so that the reader can easily navigate and understand the portfolio.
- functional; this addresses the simple question, "How *user-friendly* is the portfolio?"

Early in the COATT process, we set a scope for the M-COATT portfolio as something that a student could design in ten hours, given a basic mechanical understanding of how to construct a hypermedia document. We recognize that not every student-teaching classroom is on a level field insofar as the breadth or depth of available technologies is concerned. While student candidates are expected to be as creative as they wish in applying technology in the service of teaching and learning, those who are in a "technology-poor" classroom can still effectively compete if the degree to which the technology is employed is seamless and promotes learning in individual and unique ways.

It is expected that students will include standard fare such as sample units and lessons, artifacts of learning, artifacts of teaching (an electronic grade book, a classroom presentation, etc.) in their M-COATT portfolio.

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We will also look for evidence of thoughtful contemplation on the part of the student - a summary justification for why the student meets a portion of the standard, a portrayal of the classroom environment, and a reflection on how "well" a particular unit or lesson was enacted and received. The COATT liaison at each member institution is responsible for sensitizing their students towards addressing these areas.

We envision submissions that follow good practices of hypermedia and instructional design. The digital portfolio should be *self-guiding*, and organized in a cogent, cohesive manner. Design guidelines for the students' linear portfolio are a good starting point. However, a well-designed digital portfolio will also take advantage of the non-linear presentation of information afforded by hypermedia. One may use the following pervasive questions (Rubio, Michell, Blackwell, Albery, & Kondelik, 2000) to guide their assessment of how that non-linearity was utilized: a) What do I want my reader to know now?, b) What do I want my reader to know next?, and c) How can I take advantage of the multimedia and nonlinearity at my disposal to effectively convey my presentation?

The functional assessment will be facile. Everything should "work" - links, media, etc. The portfolio should alert the reader to specific computer hardware configurations and special software needed to view the portfolio, and include links for downloading the software as appropriate. It should be web-accessible, but is not restricted to HTML. The portfolio should be largely operating system- and browser-independent.

Another question we had to answer in the first year included just when to make the M-COATT portfolios due. We wanted to issue the M-COATT certificate early enough so that recipients would have this certificate in hand for late spring job fairs. But the preparation of a digital portfolio that included actual lessons taught with students was a challenging task, as many of our applicants would only be student teaching in the spring. In addition, the timetable had to accommodate an independent review by university teacher educators. It was decided that there would be two sets of deadlines to accommodate student teachers who taught in the fall, 1999 or the spring, 2000. A web site was opened up in early November which can be use to begin the application procedure; applications can be made and changed online until January 14, 2000. Candidates from the first group will submit a nominal registration fee and a digital portfolio in web-accessible format to their COATT liaison, who is responsible for making sure that the portfolios are installed on web servers that are secured (no further modification) after March 3, 2000. The cooperating teacher will be asked to sign the application to signify that the student teacher did actually teach the unit in their classroom. At least one representative from each member institution will gather in mid-March to review the portfolios. An iterative assessment process will be performed, where each reviewer looks at several portfolios. The assessment rubric will then be finalized, and the portfolios assessed. Representatives will recuse themselves from assessing the work of students from their institution. The first awards will be announced on or around April 1, 2000. Candidates from the second group will have their portfolios secured by May 5, 2000, and will receive award notification on June 2. If selected, the students' name will be placed on the COATT web site, they will receive a certificate, and they will be invited to a public awards ceremony.

Issues

A number of issues have emerged through the process of creating the Consortium and certificate. These include the marketing of the M-COATT, certificate opportunities for in-service teachers, and financing COATT. We set a marketing goal that the M-COATT would become a credential valued by both job seekers and those who make hiring decisions in school districts. In order to bring this about institutions participating in the consortium have agreed to take a leadership role in promoting the certificate to their students. Senator Levin's office has agreed to work with the K-12 community to market the certificate to schools and school districts. We are also working for the endorsement of the M-COATT certificate by all relevant education organizations in the state. These marketing efforts will also include working with the news media to publicize this "first in the nation" approach to upgrading technology training standards for teachers. The question of developing a parallel certificate for in-service teachers is still under consideration. One of the main questions is whether inservice teachers should be offered the same certificate for the same level of work, or a more advanced certificate that would necessarily reflect a more thorough integration of technology in their teaching methods. It is also recognized that the evaluation methodology we will use in granting the certificate may need to be modified as well. Finally there is the question of how will we pay for this "revenue neutral" project. In this era of reduced state budgets for higher education, some means needed to be found to support the ambitious goals of the COATT project. It has been agreed that the application fees for the M-COATT will be set at a level that helps screen out clearly unqualified applicants, while not discouraging qualified candidates from applying. The hope is that the revenues generated can defray some or all of the costs involved in evaluating the applicant's portfolios. Public and private grant support will be sought to cover the administrative and marketing costs of COATT and whatever portion of the evaluation costs are not met by application fees. It is expected that Consortium institutions may give some in-kind support to COATT in its start-up phase, but we also recognize that as the Consortium scales up, it will be reliant on cash resources.

Conclusion

We have only outlined the COATT standard, described the process of applying for the M-COATT certificate, and begun a discussion of some of the issues facing us as we face this task. At this writing, we are working with our first group of students who are trying to achieve the M-COATT certificate. In February while at the conference, our students will be preparing their initial digital portfolios for submission. Already we are seeing unintended benefits from the COATT process, as teacher educators responsible for preparing students in information technology at very diverse institutions have had a forum to discuss their work as they aim for a common standard. Those of us who have helped create COATT continue to believe that it will make a significant contribution to long-term efforts to improve the technology skills of Michigan educators.

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Computer Technology Courses for Pre-Service Teachers: a Comparison of Four University's Approaches

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Bob Appelman: Indiana University, Bloomington
Timothy Green: California State University, Fullerton
Lisa Hansen: University of Northern Iowa, Cedar Falls

Abstract: This paper is a description of the Educational Technology/Instructional Technology courses developed and delivered within the teacher education programs at four diverse state universities. Each university is presented as an individual case. The goals and activities of the Educational Technology courses offered are the focal point of the comparison.

Introduction

Computer technology skills have been targeted as a critical competency for teachers by organizations that include The National Council for Accreditation of Teacher Education (NCATE) and the National Education Association (NEA). A recent NEA resolution includes the statement, "Teacher preparation in instructional technology, including the development of effective materials, and appropriate instructional strategies must begin in college and university programs and extend through continuing professional development" (1997-98).

Accepting the fact that effective teacher preparation programs must include instructional technology (IT) as part of the program of study raises the issue of deciding how best to incorporate IT into the teacher education curriculum. Teacher education programs across the United States have been approaching the problem of developing IT competency through specifically designed courses. Although virtually all of the courses offered have as their goal the improvement of the learner's ability to use computing tools in educational settings, the activities developed and employed to achieve this goal vary widely from program to program.

Abbie Brown, Bob Appelman Timothy Green and Lisa Hansen are each responsible for teaching computer technology courses that are part of the teacher education programs at state universities (Washington State University, Indiana University, California State University and the University of Northern Iowa, respectively). Each reports on his or her respective environment in the following four cases.

Case #1. California State University, Fullerton

Teacher education programs throughout California are in the midst of analyzing and evaluating how credential students are being prepared to utilize technology in the classroom. A major impetus for this has been brought about by the California Commission on Teacher Credentialing (CCTC). The CCTC has recently developed standards on the use of computer-based technologies in the classroom that teachers must posses. Teacher Education programs in California must document how they are implementing these standards by June of 2000.

The credential program at CSUF is a one-year, post-bachelor program. Students entering the program come from a wide-range of academic backgrounds, with many coming from other colleges or universities. Students therefore come in with varying abilities with regard to

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technology. There currently are no technology requirements for admissions into the credential program.

The combination of the recent CCTC standards on computer-based technologies and being in the middle of NCATE accreditation process has prompted the Division of Education at CSUF to take a serious look at how prepared our credential students are in the use of technology when they leave our program. Students can leave our teacher education program without taking a technology course. However, students must demonstrate in their student teaching experiences competencies related to technology. Students are to gain experience in utilizing technology throughout the one-year credential program.

The main technology course in the department (Elementary, Bilingual, and Reading Education) I work for is EDEL415: Microcomputers in the Elementary Classroom. The class is designed for in-service teachers working on their professional credential (the credential teachers receive after their preliminary/probationary credential). Teachers must take this class along with two other non-technology related courses to receive their professional credential. The major goal of the course is to help an elementary teacher develop knowledge and skills that will allow him or her to integrate technology into their classroom. Although this course is designed for in-service teachers, many students take this course even before they are enrolled in the fifth-year credential program. Students enrolled in EDEL415 can range from novice to experienced in regard to their teaching abilities and knowledge about pedagogy.

As part of the master's program in Curriculum and Instruction, a computer emphasis can be taken that leads to a computing certificate for elementary teachers. "The Computing Certificate for Elementary School Teachers has been designed to provide elementary school teachers with a broad understanding of the applications of microcomputers in the elementary school classroom and the instructionally related tasks in the public schools. Competencies will enable participants to become computer curriculum specialists who will guide the integration of computers into the elementary school curriculum, their uses in instruction, and their applications in instructionally related activities at the elementary school."

The certificate consists of 15 semester hours. Listed below are the courses that make up the certificate.

Core Courses (13 units)

EDEL 415 Microcomputers in the Elementary Classroom (3)
EDEL 515 Problem Solving Strategies Including Logo (3)
EDEL 519 Advanced Technologies (3)
EDEL 516 Integrating Elementary School Software into the Curriculum (1)
EDEL 517 Practicum: Elementary School Teachers and Computers (3)

Elective Courses (2 units selected from the following courses)

EDEL 512 Improving Elementary Students Writing with Microcomputers (1)
EDEL 513 Microcomputer Utilities for Elementary School Teachers (1)
EDEL 514 Strategies for Using Data Base Management with Elementary Children (1)

could be done, and what can be done, is continually addressed beginning with the first required technology course.

Professional development becomes the focus instead of the lack of technology available in the field. Assessment of an individual's technology literacy is calibrated using the ISTE Standards for Basic Endorsement in Educational Computing and Technology Literacy. From the beginning, each student is made aware of the importance of self-assessment using these standards, and also with the realization that they should expect to be evaluated with them upon entering the teaching profession.

Every student is required to take an introductory course entitled "Using Computers in Education" with the following description:

> (W200 3 cr)
> **Develops proficiency in computer applications and classroom software; teaches principles and specific ideas about appropriate, responsible, and ethical use to make teaching and learning more effective; promotes critical abilities, skills, and self-confidence for on-going professional development.**

From this base the student will attend practicums and/or cohorts during their Sophomore and Junior years that explore teaching methods and technology integration. Each course offering in the School of Education is strongly urged, and supported with consultant resources, to integrate technology into its repertory. If a student wishes to gain a computer endorsement, then a special course sequence is available as listed below.

W210 Survey of Computer-Based Education (3 cr.)
W220 Technical Issues in Computer-Based Education (3 cr)
W310, Computer-Based Teaching Methods (3 cr):
W410 Practicum in Computer-Based Education (6 cr)

Keep in mind that the School of Education exists among strong departments of Computer Science, Radio & Television, Journalism, Music, Fine Arts, Business, Informatics, and Library and Information Science. Electives may be chosen from this sample list below.

Education W205 Computer Graphics for Education (3 cr)
Education F401 Application and Use of Multimedia (3 cr)
Education F401 Educational Simulations and Games (3 cr)
Education F401 Digital Video in the Classroom (3 cr)
Education W450 Internship in Computer Education (3 cr)
Education F500 Teaching With the Internet Across the Curriculum (3 cr)
Education F500 Developing WWW Sites for Public Schools (3 cr)
Education K500 Workshop in Special Education: Assistive Technology (3 cr)
Education R547 Computer Mediated Learning (3 cr)
Education R590 Teaching With the Internet Across the Curriculum (3 cr)
Education R685 Human-Computer Interface Design (3 cr)
Business K201 The Computer in Business (3)
Business X201 Technology (3 cr)
Comp Sci A201 Introduction to Programming (4 cr)
Comp Sci A247 Network Technologies and Administration (4 cr)
Comp Sci A547 Network Technologies and Administration (3 cr)
Fine Arts S300/S500 Video Art (3 cr)
Fine Arts T330 Computer Art (3 cr)
Journalism J463 Desktop Publishing (3 cr)
Library Sci L401 Computer-Based Tools (3 cr)
Music U/Z396 Introduction to MIDI and Computer Music (3 cr)

Case #3. University of Northern Iowa, Cedar Falls

The College of Education at UNI has a strong commitment to technology and requires certain technology skills from its preservice teachers. All students are required to take a basic educational technology course early in their academic careers; for many students, this required course is completed in their first semester in the College of Education. Subsequently, many of the students we see in this course are new to the concepts of technology in education from a teacher's perspective; indeed, many students are hearing words such as "pedagogy" and "objective" for the first time in our course. We therefore have to organize our required course (and additional courses offered to undergraduates) around the fact that we see them before they have taken a methods course.

In addition to offering master's degrees in educational technology and communications and training technology, UNI provides an educational technology minor. We currently have about 22 students minoring in educational technology. This 18-hour minor includes 4 required courses and 2 electives, listed below. Eight educational technology courses are available to undergraduate teacher education majors. The first two courses listed below are the basis for all the others and should be taken first, in this order.

- Educational Media and Classroom Computing is required of most undergraduate education majors. This course is a general introduction to educational technology and media, and combines lectures and labs into a hands-on and survey/reading class. We offer six sections of 60 students each semester.
- Classroom Computer Applications is a follow-up course to Educational Media, and is required of technology minors. It is offered once a year and is much smaller in size (about

10-12 students). This class takes many of the skills and principles learned in Educational Media a step farther.

- Technology in Education is an undergraduate/graduate level course, and is a survey of the history, issues and trends in educational technology. This couse is required of educational technology minors, and should be taken after the two listed above.
- Media Planning and Production is an undergraduate/graduate level course, required of educational technology minors, and should be taken after first two listed above. This class oftens acts as the graduate level introduction to technology course (much as Ed Media does for undergraduates), and thus provides more of a theoretical and in-depth base for skills and process development for undergraduates.
- Databases in Education is an undergraduate/graduate level course, and a minor elective. This course covers the use and development of databases in education, to support and enhance learning.
- Telecommunications in Education is an undergraduate/graduate level course, and a minor elective. Telecommunications encompasses the issues of using computers, video, and other communications methods to expedite learning.
- Media Projects is undergraduate level course and a minor elective. This independent project gives students the opportunity to pursue projects of interest to them, and to further the development of skills.
- Principles of Publication Design is an undergraduate/graduate level course, and a minor elective. This class covers the design and development of print and web-based publications.

Case #4. Washington State University, Pullman

The Department of Teaching and Learning within Washington State University's College of Education currently requires all students seeking certification in elementary education to take a course entitled Technology Used in the Schools (TL445). Approximately 225 students graduate with provisional certification (state license) each year. Beginning next year, this course will also be a requirement in the secondary education certification program (approximately 200 students graduating each year). Currently, this is the only Educational Technology course available for undergraduates in the College of Education.

The teacher certification program at Washington State University (WSU) is selective; students may apply for admission to the program in their sophomore year (a process which includes interviews, a record of eighty hours of direct contact with children in supervised educational settings, and review of the applicant's grade-point average). As freshmen, students at WSU are exposed to orientation experiences that include the use of e-mail and web-based communication; many students have experience with web-based conferencing (many professors are adopting WSU's proprietary Speakeasy web conferencing system as a supplemental class activity). Students are generally well acquainted with word processing, spreadsheet and communications (e-mail) software: a recent survey of the students enrolled in the College of Education's Teaching Elementary Mathematics course indicated that all but one of the fifty-three respondents had access to a computer in their home. Washington State University prides itself on being the seventh "most-wired" university according to Yahoo! Internet Life (1999).

Objectives and Rationale of WSU's TL 445: Upon successful completion of the course, students should increase their ability to implement and evaluate technologically innovative instructional activities, Because the current trend is toward making improved use of digital technologies (i.e. Personal and/or networked computer-based presentations and interactive activities), all course activities will relate directly to computer-based presentation and instruction. It should be noted, however, that many of the concepts and procedures introduced during the course are general standards of effective instructional design and can therefor be applied to any technologically innovative instructional situation. The presumption is that the technologies currently in vogue will very probably be replaced by emergent, differing technologies during the course the of the student's teaching career, while standards of effective design and instruction will remain relatively stable. The course goals and activities are based on the recommended practices put forward by the International Society for Technology in Education (ISTE).

In accordance with the ISTE Recommended Foundations in Technology for All Teachers, (currently accepted by NCATE) students will:

- Be assessed early in the course to ensure their basic competency in the operations and concepts of computers and technology (support is provided for students in need of basic skill development). Basic competence tasks are assigned (i.e. HTML generation and articulation of essential computing concepts) in which students are required to word process, invoke network protocols (e.g. TCP/IP, http) make use of multimedia tools, and manipulate digitized images.

- Develop instructional media for personal and professional use. Students design, produce and evaluate instructional multimedia (specifically, a web site and an authored, stand-alone software package). Students learn to use and employ a variety of productivity tools including image manipulation software, digital cameras, digital sound editing software, internet-based resources, and authoring software (e.g. HyperStudio, web (HTML) editors, Macromedia Director). An anticipated side-benefit of this activity is the development of a professional portfolio of innovative instructional media created by the student and applicable to the student's intended teaching situation. Ethical use of computers and related technologies (with emphasis on copyright issues) are discussed at length during the course of the semester.

- Apply technology as an instructional tool, exploring and evaluating its potential use through problem-based, practical activities that draw on the students' knowledge of both subject matter and pedagogy. Through the application of instructional design protocols and practices (e.g. needs analysis, user-centered design, usability testing), students will develop greater sophistication in both the use of innovative technologies and the facilitation of the learning process. The obligation on the students' part to produce clear documentation of the intended instructional outcome and the product's development is intended to help students better reflect upon and understand the design/production process and its implications for developing instructional materials. In generating their own instructional software, students develop a personal understanding for the need to apply legal and ethical restrictions upon software and software components (including digitized images, video, and sound); it is to be hoped that students with direct, hands-on experience with creating these components will gain a greater appreciation for the time and effort involved in their production as well as the value placed upon them by their creators. A culminating activity of developing an evaluation protocol for an actual educationally oriented technological innovation encourages students to develop an increased understanding of responsible, ethical and legal uses of technology, information, and software resources as well as the application of quantitative and qualitative measures of success in facilitating the learning process.

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Doing IT Down Under: Uses of Information Technologies in an Australian Degree for K-6 Teachers

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Abstract: This paper discusses the Information Technology (IT) skills that are developed in the Bachelor of Education (Primary) degree at the University of Melbourne, Australia. Students graduating from this degree will be K-6 (also known as primary or elementary) teachers. The study shows that IT skills are developed over the four years of the course with the students progressively developing both generic IT skills and IT skills specific to curriculum areas.

Introduction

The Bachelor of Education (Primary) [B.Ed.(P)] degree is the principal vehicle for training primary teachers at the University of Melbourne in the Australian state of Victoria. [In Australia the term 'primary' is used to refer to K-6 education, thus what is known in the USA as 'elementary school' is referred to in Australia as 'primary school'.] In the state of Victoria there is a strong emphasis on the uses of Information Technologies (IT) or learning technologies in the classroom (Victorian DoE 1999a) with a number of major IT initiatives in place that make it critical that our graduates have good IT skills. This paper will discuss how IT skills are developed in the four year B.Ed.(P) course for pre-service K-6 teachers.

In 1995 the B.Ed.(P) degree at the University of Melbourne was restructured and updated extensively with a move from an activity-based course to emphasise a scholarly, research-informed basis of teaching and learning. New first year subjects were introduced in 1996 and later year subjects were progressively implemented from 1996 to 1999. See Table 1 for the titles of subjects undertaken by students in the new course. In the 1999 academic year the first cohort of students of the revised course were in their final year. Over the period of the development and implementation of the new course structure there has been an ever-increasing impetus to prepare our students - as much as is possible in the changing world of IT - for significant uses of IT in their teaching careers, which may extend to 2040!

In addition to the restructuring of the course for the above reasons, budget constraints imposed a rethinking of the delivery of the course and of the ways in which students undertake practical experience in schools ('teaching rounds'). From 1997 a reduction of 20% was made to the number of days of supervised practical work in schools. In response, interactive multimedia has been used in some subjects to make 'experiences' with children a well-integrated part of the university course and to maximise the learning experiences of our students while on teaching rounds. Development of multimedia resources has been undertaken within the Faculty of Education and has been progressing as funds and time allow it (see Chambers & Stacey 1999, Asp, Chambers, Scott, Stacey & Steinle 1997, Chambers, Asp, Scott, Stacey & Steinle 1997 for descriptions of some of the multimedia projects for use in teacher education). Using such multimedia resources as part of their course work also models to our students some of the ways that IT can be used to facilitate learning.

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The eight first year subjects are:

- Studies of Society and Environment
- Arts 1
- Health & Physical Education 1
- Language & Literacy 1
- Mathematics 1
- School Experience 1
- Science and Technology 1
- Children, Schools and Society

The eight second year subjects are:

- Indigenous Australian Studies
- Educational Theories and Practices
- Arts 2
- Health & Physical Education 2 [standard or advanced]
- Language & Literacy 2
- School Experience 2
- Maths 2 [standard or advanced]
- Computers in the Primary Classroom

The ten third year subjects are:

- Science and Technology 2 [standard or advanced]
- Arts 3 [option]
- Children's Literature [option]
- Mathematics 3 [standard or advanced]
- School Experience 3
- Studies of the Australian Environment [option]
- Curriculum and Teaching [standard or advanced]
- Children with Special Needs [standard or advanced]
- Health & Physical Education 3 [option]
- Language & Literacy 3 [standard or advanced]

The nine fourth year subjects are:

- Issues and Contexts in Education [standard or advanced]
- Research Project / Honours Research Project
- Curriculum Integration [standard or advanced]
- Arts 4 [option]
- Health & Physical Education 4 [option]
- Language & Literacy 4 [standard or advanced]
- School Experience 4
- Science & Technology 3 [standard or advanced]
- Mathematics 4 [standard or advanced]

Table 1: Subjects undertaken by students in the Bachelor of Education (Primary) degree at the University of Melbourne, Australia.

Methodology and Rationale

A survey was undertaken at the end of the 1998 academic year regarding uses of Information Technology (IT) in all subjects of the Bachelor of Education (Primary) course. Information was gathered in most cases through an interview with the subject coordinator and, for the small number of subjects where a suitable interview time could not be arranged, the subject coordinator completed a survey checklist without interview. Data for years 1 to 3 reflect actual usage of IT for the subjects in 1998, whereas information for year 4 was a projection of intended usage, as 1999 was the first time year 4 of the revised course was taught.

The reasons for undertaking this study were:

- to inform subject coordinators of students' exposure to IT and the skills that could reasonably be expected of students entering a subject;
- to gain an overview of IT skill development in specific subjects so that development of IT skills could progress over the four years students were in the course; and,
- to establish use of IT in the course in 1998 so that these data could be used for comparison in later years.

The IT skills documented are those that were required to complete the subject; although many students within a subject may have used other forms of IT these were not included in this study. For example, students may have emailed lecturers, developed Power Point presentations, or used the Internet for research while undertaking a subject, but these are only documented if they were a specific requirement of the subject. The reason for this was so that we could confidently say that all students had made the stated uses of IT while undertaking a subject.

Results

Basic uses of IT such as file creation and management, using word processors and spreadsheets, and using electronic resources such as the WWW and CD-ROMs for research developed over the four year course, with some subjects such as Science & Technology, Mathematics, and Arts introducing students to IT tools specifically relevant to that learning area. See Figure 1 for a summary of findings.

Uses of IT in Year 1

All first year subjects of the B.Ed(P) required students to submit word processed assignments which incorporates the basic IT skills of file creation and management, entering and formatting text, word processing, and printing. Other basic IT skills and experiences were developed in most subjects with students required to use spreadsheets in four subjects (of eight subjects), to access the Internet for lecture notes and teaching materials in five subjects and to use CD-ROMs to find information for four subjects. Using email and participating in electronic discussions was part of two subjects, with students in 'Mathematics 1' required to report to the electronic discussion forum about their analysis of interviews about children's understanding of decimal numbers they undertook while at a school. Students then had to respond to the findings of other students.

First year students were introduced to the Education Faculty's web site in both 'Mathematics 1' and 'Science & Technology 1' subjects, which included establishing and logging into university computer account, using a web browser, and using the AltaVista student discussion forum. Using databases was introduced in two first year subjects, 'Health and Physical Education 1' required students to upload data they had collected while in schools into a database via a web interface and using databases was also introduced in 'Science & Technology 1'. The uses and evaluation of IT resources in schools was included in three subjects.

As expected, some subjects introduced students to IT tools specifically relevant to their learning areas. In the subject 'Science & Technology 1' sensors and probes were used for data logging to measure and record temperatures, and in 'Mathematics 1' graphics calculators were introduced.

Uses of IT in Year 2

The second year of the course built on skills developed in first year and, as with first year, all subjects required students to use computers to prepare work submitted for assessment. In general, in second year of the course there was a greater emphasis on students developing skills in using electronic resources available via the Internet, particularly the World Wide Web (WWW) or on CD-ROM. Most second year subjects required students to use the Internet in some way, whether it was accessing the Faculty home page, using email, or searching the WWW for course-related information.

Education library staff introduced students to the local university library system, the 'Buddy' database, which includes paths to access ERIC in the both 'Educational Theories and Practices' and in 'Computers in the Primary Classroom'. The ability to access and evaluate information from the Internet is seen as both crucial to the future teaching careers of our students and an area that was new to most students. As in first year, a number of subjects required students to use of evaluate software for classroom use.

Use of IT in BEd(P) subjects [1998]	BASIC USES OF IT															
	creating files	managing files	word processing	printing	use web to access lecture notes	using spreadsheets	use web to access materials you have located	finding info on a CD-ROM	find info on the web	using email	using electronic discussion forum	access database to find info	enter data into a database	use technology in schools	use/evaluate sw for classroom use	developing presentations
First year subjects																
School Experience 1	■	■	■	■												
Studies of Society and Environment	■	■	■	■												
Arts 1	■	■	■	■												
Children, Schools and Society	■	■	■	■		■	■	■								
Language & Literacy 1	■	■	■	■			■	■						■		
Health & Physical Education 1	■	■	■	■	■	■		■		■	■		■		■	
Mathematics 1	■	■	■	■	■	■	■				■					
Science and Technology 1	■	■	■	■	■	■	■	■					■		■	
Second year subjects																
School Experience 2	■	■	■	■												
Indigenous Australian Studies	■	■	■	■	■											
Educational Theories and Practices	■	■	■	■	■							■				
Arts 2	■	■	■	■				■	■					■		
Language & Literacy 2	■	■	■	■				■	■	■		■			■	
Health & Physical Education 2 [std or adv]	■	■	■	■	■	■			■						■	
Maths 2 [std or adv]	■	■	■	■	■		■	■	■	■				■	■	
Computers in the Primary Classroom	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■
Third year subjects																
Children with Special Needs [std or adv]	■	■	■	■												
Health & Physical Education 3 [option]	■	■	■	■												
Language & Literacy 3 [std or adv]	■	■	■	■												
School Experience 3	■	■	■	■	■											
Arts 3 (option)	■	■	■	■				■	■					■	■	
Childrenís Literature [option]	■	■	■	■				■	■		■	■				
Mathematics 3 [std or adv]	■	■	■	■	■		■		■		■	■				
Science and Technology 2 [std or adv]	■	■	■	■	■		■	■	■			■		■	■	
Curriculum and Teaching [std or adv]	■	■	■	■			■	■	■			■				
Studies of the Australian Environment [option]	■	■	■	■			■		■	■		■			■	
Fourth year subjects																
School Experience 4	■	■	■	■	■											
Issues & Contexts in Education [std or adv]	■	■	■	■	■				■			■				
Research Project [std or hons]	■	■	■	■					■			■				
Curriculum Integration [std or adv]	■	■	■	■	■	■		■	■					■	■	
Language & Literacy 4 [std or adv]	■	■	■	■				■	■	■		■			■	

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Figure 1: The uses of IT in subjects of the B.Ed.(P) course grouped by year of course.

As expected, the subject 'Computers in the Primary Classroom' introduced a wide range of uses of IT and developed IT skills upon which other subjects could build. For example, the programming language Logo (as part of the computer software Microworlds) was introduced in 'Computers in the Primary Classroom' and the uses of Logo in developing children's mathematical understanding was developed in 'Mathematics 2'. Using HyperStudio to develop simple multimedia resources suitable for use in a K-6 environment and all that it entails – using a scanner, creating and modifying images, working with sound files, etc. –developed in students a range of both practical IT skills and the IT concepts relating to object oriented programming. Creating web pages also allowed students to consolidate their uses of a range of file types and develop another avenue for electronic communication. All lecture and weekly workshop notes for this subject were available online and a CD-ROM (Chambers & Dobbins 1997) with other multimedia resources developed for the subject available to supplement the weekly lecture and workshop. Through this regular access to resources via technology, by the end of second year access to the Internet and WWW was a routine part of all students' academic tasks. This was not true of the students when entering second year.

Uses of IT in Year 3

By third year of the course the IT skills of students are well developed and all subjects assumed basic IT skills and most subjects expected students to use databases, the Internet and CD-ROMs as a routine part of the research process. Again, using and evaluating IT resources for use in schools was required in a number of subjects. Intensive use of web sites was made by a number of third year subjects with 'Mathematics 3' having all lecture notes, a bibliography, workshop feedback and a weekly on-line quiz available only via the WWW. In one subject, 'Studies of the Australian Environment', students consolidated a range of IT skills by developing a multimedia resource and creating a web site.

Uses of IT in Year 4

The fourth year of the revised course was not taught in the 1998 academic year (the new program was not taught until 1999) so the information supplied was of predicted uses of IT in these subjects. All fourth year subjects will have information about the subject and lecture notes available via the web and will expect students to be able to use databases such as ERIC for assignment research. Most fourth year subjects expect and develop basic IT skills and a number, particularly 'Arts 4', 'Science and Technology 3', and 'Mathematics 4' make extensive uses of IT in a subject-specific way. For example, in the subject 'Arts 4' students scan, create and manipulate digital images and in 'Science and Technology 3' intensive usage of IT is required to demonstrate scientific understanding through multimedia resources and to create and use simulation software.

Discussion

Needs of Victorian Teachers

Unlike in the USA or the UK, it is the usual practice for Australian university students to go to a university in their home state, with over 90 per cent of Australian students attending a university in their home state (data extracted from Table 10, p26, DETYA 1998). Thus, it is a reasonable expectation that most students undertaking a teacher education course at the University of Melbourne will be from Victoria and are likely to start and, for many, continue their teaching career in Victoria. Because of this, the initiatives of the Victorian Department of Education (DoE) and its requirement of IT skills of teachers are very likely to be of relevance to teacher education graduates of the University of Melbourne as the Department of Education is the major employer of teachers in the state. Like Education Departments across the developed world, the Victorian Department of Education has encouraged the use of IT in the classroom and Victoria is leading the way in Australia in the uses of IT in the classroom. Among the initiatives of the Victorian DoE is a program started in 1998 to provide up to 36,700 notebook computers to all principals and teachers in Victorian Government schools over a period of five years. This is a three-year lease arrangement with teachers paying AU$450 over the three year period - approximately AU$3 (US$2) per week (Victorian DoE 1998). This is to encourage teachers to have their own laptop computer so that IT skills can be developed and so that IT tools become a standard part of all teachers' 'toolbox'.

The Victorian DoE has also prepared a 'Learning Technologies Capabilities Guide' (Victorian DoE 1999a) that suggests goals for skill development in a full range of learning technologies and includes a 'Skills Development Matrix' that identifies six key skill areas for Victorian teachers for using IT (Victorian DoE 1999b). These are: (i) using and managing technology; (ii) using basic computer applications; (iii) using desktop publishing and presentation software; (iv) using multimedia; (v) using communication technologies; and (vi) using learning technologies in the key learning areas (Victorian DoE, 1999b). Thus it can be seen that it is crucial that, in addition to the raft of other skills required of a teacher, our new graduates are skilled in these areas of IT use.

IT skill development of our students

In combination with increasing availability of computers - almost all students have access to a computer at home - and the increasing use of computers for recreational activities, our later year students now regard IT tools as 'nothing special' and use them as a routine part of any piece of work without thinking twice. This is a very different situation from when the students now in the final year of the course were in second year (1997) and for many turning on a computer was an uncommon activity. In more recent years students are entering the course with more advanced IT skills and significantly greater exposure to IT, usually through using the WWW for recreational purposes. This change in the students' attitudes and abilities with IT is both a mirror of the changes in the local community and a reflection of the continued exposure and uses of IT required in the subjects the students are studying.

From this study it can be seen that from the first year of the B.Ed.(P) course basic IT skills are introduced and reinforced each year, with some subjects introducing IT tools of specific relevance to that learning area. That IT skills were not further developed and more use made of IT in the third year of the course, in particular in the year following a year-long subject specifically about using computers in K-6 teaching, was made evident through this study. Greater use of IT in the third year of the course is desirable to consolidate and extend the IT experiences and skills developed by students in the first two years of the course. Now that this is evident, later year subjects can respond by increasing the range of IT skills students develop. In addition, as the IT skill levels of students entering the course rise more emphasis can be placed in the area of using IT with children in classrooms to enhance teaching and learning, rather than the mechanics of using IT tools.

Conclusions

It is now demanded that new teachers will be competent in using IT both for their own professional purposes, such as research and administration, and for enhancing teaching and learning in their classrooms. This overview of how IT skills are developed in one teacher education course for prospective K-6 teachers has demonstrated that over the course of four years through requiring our students to undertake certain tasks using IT even the most technologically-reluctant student must engage with IT and must develop the skills demanded of a teacher in the new millennium. The study has exposed some areas where greater uses of IT could be made, in particular in the third year of the programme, and has highlighted the need to keep 'raising the bar' of IT skill development to keep up with the ever-increasing IT skills of entering students.

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Mentoring, Case Studies, and Preservice Teachers: A Study of Analyzing the Use and Impact of an Electronic Bulletin Board

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Abstract: Advances in technology have made access to the Internet available to more and more individuals and have extended the traditional classroom walls. Incorporating the use of the Internet into teacher education programs is an important way to develop future teachers competent in technology implementation. The purpose of the project was to determine if students could interact with students at another university concerning pedagogical and professional issues.

Introduction

Advances in technology have made access to the Internet available to more and more individuals and have extended the traditional classroom walls. Incorporating the use of the Internet into teacher education programs is an important way to develop future teachers competent in technology implementation. Furthermore, it has been suggested that the Internet is the fastest growing educational phenomenon in the history of the world (Dryli & Kinnaman, 1995). Driven by the desire to enhance preservice teachers' technology experiences we created an electronic bulletin board project. Our methods were developed through literature searches of other successful electronic communications studies (Downs & Rakestraw, 1997, Gamas & Solberg, 1997). Gamas and Solberg (1997) identified several strengths of including electronic bulletin board discussions in their courses. Some of these strengths include using time outside of class to research topics, students' have an increased comfort level with their peers, and value of the online discussions and technology use. "Providing a greater integration of technology into teacher preparation programs" was a driving reason for introducing technology into a course (Downs & Rakestraw, 1997).

The purpose of the project was to determine if students could interact with students at another university concerning pedagogical and professional issues. As teacher educators we believe that use of the bulletin board will allow for professional networking and provide students an opportunity to express their beliefs and concerns in an open forum outside of class with peers and current professional Physical Educators.

Methodology

Project participants included undergraduate teacher education majors at two universities (n=44), mentor physical educators (21) and two university professors. WebCT was the software package used to support the electronic bulletin board communication. In addition to the electronic bulletin board students utilized WebCT's internal homepage development feature. Creation of homepages was intended to provide participants with a vehicle for learning and to establish a sense of community. All of the project participants completed the

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homepages within the first two weeks of the project. Students and mentors were also encouraged to access the homepages and learn more about their online peers.

The bulletin board project was designed to provide the college students with an experience beyond the traditional classroom and with the opportunity to professionally network. Gamas and Solberg (1997) studied the use of electronic communication tools in five separate university courses. Their methods section suggested the use of professor posted messages to electronic bulletin board to begin the interactions. This same strategy was used in our study. Approximately every three weeks throughout the semester the professor at the Midwestern University site posted a case study and guided questions (collaboratively developed between professors) to the main forum. Participants were encouraged to respond to the cases and questions by posting a message in reply to the case. Topics included cases on the coaching issues, drug/steroid use, student teaching loyalty, and establishing boundaries with students. Participants were encouraged to openly discuss their opinions on the main forum.

Data Sources

Data sources for this project included participant responses to the case studies, interactions between undergraduate students and mentors, and survey results upon completion of the project. Qualitative methods (Bogdan & Biklen, 1992) will be used to document and describe the process of identifying emerging themes. To organize analysis of data sources, the theoretical perspectives and methodological approaches of structuralism will be enlisted. Structuralism views "documents" as "texts" (Manning & Cullum-Swan, 1994, p. 467). As such, once the data is accumulated in written form, it will be read through several times. With each reading a set of tentative themes will develop. The emerging themes and issues arising from the readings will create the codes or interpretive frames that guide and structure the analysis. Trends and commonalties will inform researcher understandings of participants perspectives on the case study issues. Finally, the surveys will provide information concerning the attitudes of the participants toward the value and perceived gains of connecting undergraduates with mentors in an effort to discuss teaching issues.

Results

Data from this project are still being collected, but preliminary results will be reported during the SITE session. The results of this project will add to the collective knowledge of mentoring and technology implementation at the university teacher preparation level. It is further intended to provide insight concerning teachers experiences in school settings versus the idealized perspectives of undergraduate students who have never taught a course with students in the school systems.

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Collaboration: The Chemistry Between Colleagues

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Abstract: This paper examines one collaborative effort developed to improve pre-service teacher attitudes toward teaching with technology. An interview and email exchanges were used to determine the history of the project, the benefits, and the problems associated with this collaborative effort. Recommendations for further collaborative efforts are also included.

Introduction

"We think that interdisciplinary collaboration holds special promise for research on teaching and teacher education because it addresses the multifaceted nature of teaching and learning to teach." (Eisenhart & Borko, 1991)

While attending a conference on technology and teacher education, the keynote speaker began his remarks by asking the audience this question, "How many of you have been approached by faculty from the Arts or Sciences to work with them on using technology for teacher preparation?" I was the only one out of several hundred teacher educators to raise his hand.

During my first year (1995-96) at Northern Kentucky University (NKU), my chair, Ken Carter, asked me to attend a meeting with him and two members of the Chemistry faculty. At that meeting, Vinay Kumar and Julia Bedell described a new course they had developed for elementary and middle school pre-service teachers. The course utilized some of the latest technologies to deliver the content in the lecture sections and to perform experiments in the laboratory. I was excited about what they were doing because I had been exploring the use of many of these same technologies in my eighth grade science classes prior to joining the professorate. What Vinay and Julia were looking for was a faculty member from the School of Education to collaborate with on assessment and evaluation of the project. There was compensation for time and travel as a result of a grant. I volunteered. Thus began a fruitful collaboration between faculty of the Chemistry Department and the School of Education at NKU.

This paper will examine the history, benefits, problems, and future of collaborative programs to improve teacher education programs.

According to Robert Freeman (1993, p.33), collaboration is: "the condition that occurs when two or more people or organizations join forces over a long period of time to produce something neither can produce alone. In the process, each participant contributes something significant and different, derives something of personal and/or organizational benefit, and acknowledges the mutual dependence on the other required to achieve the mutually desired results."

History of the Project

Vinay Kumar, Professor of Chemistry, provided the history of this collaborative effort. "The proposal for this project was originally submitted by Leslie Leverone. Soon after the proposal was funded, Leslie left to accept another job. Before leaving, she asked me if I would be interested in becoming the principal investigator and conduct this project. I said yes. I became interested in this project because of its two main goals: To improve students' attitudes toward the learning and teaching of chemistry, and to develop students' problem-solving skills through discovery and guided-inquiry activities. Subsequently, Julia Bedell and I expanded the project to include the following additional goals: To integrate technology in both the lecture and lab courses, to enhance learning through multimedia presentations, and to provide information about chemical education, energy and educational technology resources."

Benefits of Collaboration

In an interview with all participants in this collaboration, the following benefits were mentioned. Julia Bedell provided the following comments: "Vinay and I started to work together on this new chemistry curriculum in the fall of 1994. Within the first year, we recognized that an important component of curriculum development is assessment. While developing a pre-and post-survey to assess our proposed new course, we recognized that collaborating with an expert in the area of evaluation would greatly enhance the project. We approached…Vern, who has always maintained a close relationship with the School of Education to arrange a meeting with interested Education faculty members. We were very fortunate that Ken Carter, acting chair of the School of Education, was very supportive and promptly met with us along with Steve Walker, and [you], from his department. Through [your] contributions we were able to develop, administer, and process multiple evaluation instruments that better measured the impact of this new curriculum. Our cooperative efforts which led to scholarly publications and permanent curriculum changes reaffirm the age old saying, 'The whole is greater than the sum of its parts."

Vern Hicks added, "There are several benefits. First of all, you look at different ways of presenting things. Secondly, I think that the people in the School of Education have more experience in communicating to school teachers and identifying with the discipline problems that we don't have in the colleges. So it helps in really meeting the needs of teachers in terms of where they are... I found that some of the tips I picked up while working with teachers and teacher educators, I use in my own classroom. While coming up through the science program, I never had a formal course in education. So some of the questioning techniques, some of the ways of presenting things that KTIP [Kentucky Internship Program] and KERA [Kentucky Education Reform Act] emphasize are finding their way into my own teaching."

Vinay replied to the question, "What benefits have you found through collaborating with other faculty members?"

"We have a strong and friendly working relationship with the School of Education at NKU. Prior to this project, Education and Chemistry faculty had worked jointly to establish and support science and chemistry alliances for middle and high school teachers. The curriculum for the new chemistry course (CHE 105) for pre-service elementary teachers developed under this project was modified with input from the education faculty. Two surveys that are used for assessment in this course were refined based on the input from [you] and Ken Carter, faculty in the School of Education. This type of cross-college interaction has proved to be extremely beneficial and has enabled us to successfully implement the KERA reforms."

I find working with faculty from the Chemistry Department personally and professionally rewarding. Besides the opportunity to attend and present at conferences, I enjoyed writing an article, "Technology: Catalyst for Enhancing Chemical Education for Pre-service Teachers" (1999), with Julia and Vinay. I also feel validated in my field when asked to share and utilize my expertise in educational assessment and research. I recall one particular meeting with Vinay and Julia fondly. We were discussing performance assessment in their class. I told them about rubrics, "the criteria for judging students' Popham, 1998, p.148). When told that students should be provided with these prior to the performance, Vinay's response was, "You mean you tell the students beforehand how they'll be graded?" I replied in the affirmative. Vinay thought a while and said, "Interesting. It could eliminate some of the problems I have with students arguing about their grades." After our meeting, they developed a lab practical as part of the final exam with a rubric. The students did well.

Problems

During the interview, only two problems connected to this collaboration were mentioned. The first dealt with time. Vern summarized this concern, "It's very hard to find time to work with people from the School of Education because so many of you work in the field and spend so much time advising students. The main problems I've had are in terms of arranging times. I can't think of any friction

I do find it difficult to arrange my schedule to fit with the others. Teaching and supervising off campus makes it hard to attend meetings with faculty from other colleges.

The second concern dealt with lack of recognition for participating in these types of projects. Vinay stated, "Overall, our chair has been supportive. I did point out to him that these activities—developing multimedia lessons or computer-interfacing lab experiments, their assessment based on collaboration with faculty in other colleges, etc.—are extremely time consuming and should be treated as scholarly activities, and recognized as much as doing research with students. As far as deans are concerned, the Dean of Arts and Sciences is very enthusiastic and serves on the board of the grant provider. When he sees faculty from two different colleges collaborating, he personally thinks it's great. "

]here are groups within the sciences that want to collaborate and other groups that think that science [faculty] should work only within their departments and not work with other departments. No offense, but there are those who think that faculty in departments of education show people how to do something without having a substantial background in that field, and this perception is not limited to the sciences."

The School of Education tends to look quite favorably on these types of activities and has encouraged faculty to seize opportunities to collaborate with faculty from other departments.

The Future

As schools, colleges, and departments of education come under more scrutiny by state legislatures and as NKU endeavors to strengthen and enhance P-12 math and science education through its new Center for Integrative Natural Sciences and Mathematics (CINSAM), it will be necessary to build more bridges between faculty. Janice Fauske (1993) notes that lack of collaboration between arts and science faculty and teacher education faculty inhibits effective reform of teacher preparation programs and the development of programs such as CINSAM. To foster and promote collaboration at colleges and universities that improves teacher education programs and increases the likelihood of successful integrated programs, Fauske (1993) recommends five sustaining conditions. The first is administrative support that legitimizes collaboration. Second is viewing collaboration as legitimate research. Establishing arrangements for encouraging communication is third. Fourth is building consensus around shared goals. And fifth is the institutionalization of collaborative practice.

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Discovering South Dakota Through Telecollaborative Means

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Abstract: This paper focuses on the Discover South Dakota Tellecollaborative Project and how South Dakota State University is using the project to tie together technology and teaching in the preservice required computer class. Two semesters of the computer classes have been involved in this project providing some interesting experiences and anecdotes in response to technology and collaboration. The paper will touch on the telecollaborative curriculum in the Discover South Dakota project. Students in the preservice computer classes provide clues for the Mystery City portion of Discover South Dakota, involving them in a rich opportunity to make technology come alive. Finally, the paper will examine how the project reinforces the opportunities that technology provides in the classroom for preservice teachers.

Introduction

The emphasis on technology in preservice education has been significantly heightened in our state. South Dakota was awarded a technology challenge grant in 1998, and has been using the grant to strengthen the means in which K-12 students and teachers interact with preservice students. The technology challenge grant (Learning Organizations for Technology Integration – (LOFTI) provided a connection between Technology Innovations in Education (TIE), K-12 teachers and higher education. The focus of the grant and the people involved in the grant has been to provide technology-rich curriculum to preservice students as well as providing practicing teachers the opportunity to strengthen their skills with technology.

Through this grant, individuals were introduced to a project called Discover South Dakota, which was being piloted with a few school districts around the state. The project facilitated by TIE provided a telecollaborative environment in which fourth, fifth, and sixth graders studied about South Dakota history and geography. The facilitators of the project asked if the Integrating Computers into the Classroom students would like to participate in the Discover South Dakota Project by providing clues for the Mystery City section. The request for participants occurred during the Spring 1999 semester so the project was quickly inserted into the current schedule. After participating, my students indicated verbally at the end of the Spring 1999 semester that this was a project they enjoyed and felt beneficial to understanding technology use in the classroom.

The focus of this paper is on the Discover South Dakota Project as it is being used in the South Dakota State University's Integrating Computers into the Curriculum class. It is an opportunity for the preservice students to interact with K-12 students using technology. First, the paper will touch on the telecollaborative curriculum in the Discover South Dakota project in particular the Mystery City component. Next, the paper will discuss how preservice students become involved in the project and the requirements of the classroom assignment. Finally, the paper will examine how the project reinforces the opportunities that technology provides in the classroom for preservice teachers.

Mystery City

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In the book, Virtual Architecture: Designing and Directing Curriculum-Based Telecomputing, (Harris, 1998), telecollboration is defined as "using a computer connected to a telecommunications network, like the Internet, to collaborate with others at a distance" (p. 133). The Discover South Dakota Project involves students by connecting at a distance through the use of the Internet. The project focuses on fourth, fifth, and sixth graders during the South Dakota history curriculum. "South Dakota students can explore the rich and diverse heritage of the Land of Infinite Variety through creative projects and telecollaborative connections to classrooms statewide," (TIE, 1999). Teachers that utilize Discover South Dakota are provided with training and curriculum materials to use during the project. There are various activities associated with Discover South Dakota: three themes, weekly features, and an area for the K-12 students to participate with one another and outside experts. Also available online is a teacher's resource page. There is a cost for K-12 schools to participate in the project.

The three themes are used to explore South Dakota each focusing on specific questions about South Dakota's diversity, people and events, and places. The weekly features include "
which display photos from the nooks and crannies of the Cultural Heritage Center in which students are asked to guess what the object is. Another feature is "Mystery City", which is the feature the EDFN 365 students were involved with. In Mystery City, clues are provided for students to research and reason the answer as to what the Mystery City is for the week. Fourth, fifth, and sixth grade students with the help of their teacher check the Mystery City site during their Monday class. Some students do venture guesses on Monday based on research that they may have completed previously. Clues are posted daily so the classrooms generally check the site daily.

Preservice Participation

In early Spring 1999, preservice students in the Integrating Computers in the Curriculum course were asked to provide clues for the Mystery City portion of the project. The preservice students worked in groups and started to participate in the project as an add-on project in our syllabus. The preservice students were given an option, they could participate in the Mystery City project or choose to complete the course's original final project. Over 85% of the students opted to participate in the Mystery City Project. As part of the project, the groups also created a PowerPoint presentation about their city. They also put together information about their expectation of the project and what they discovered about student's abilities to research by responding to the questions of:

- What went well and what did not go so well
- What was learned about how kids think and do research
- What was unexpected
- How might this approach be adapted for other teaching/learning activities

These groups submitted their Mystery City clues to the project and three groups were chosen to participate. The clues were posted each day by the project director and the fourth, fifth, and sixth graders sent emails to the selected preservice students, furnishing what the kids thought the correct answer was. The preservice students emailed back to the K-12 students providing feedback about the answer and giving additional suggestions and encouragement to the K-12 students. Three groups participated by facilitating Mystery City during March. These students indicated that the K-12 students were providing reasons for their answers and for the most part were using the clues to deduct the correct answers. The groups averaged about seven messages a day during their week of Mystery City. That number was affected by the high number of classrooms participating in our first week, the second week had a lower rate of participation.

Overall, the preservice students that participated expressed satisfaction with the project. One student emailed comments stating the opportunity showed to her that technology has a place in the classroom, even in the primary and middle school levels. When asked about retaining the project for the next semester, students agreed that the project should stay in the course curriculum; suggesting, however, more structure for participation in the project. Other comments focused on the competitive nature of the project – only three groups can participate so not all the EDFN students experienced contact with the K-12 students. However, the number of groups actually facilitating the project are determined by an outside entity.

The following fall semester, the Mystery City project was formally incorporated into two sections of the Integrating Computers into the Curriculum syllabus. The design plan was to devote time and energy to research and produce not only clues for Mystery City, but also a virtual tour of the city along with some historical background. Therefore three weeks were allotted for the Mystery City "Unit". Students were instructed in the use of PowerPoint presentations, information searching, and the use of digital cameras and scanners before starting the project. The EDFN 365 students would learn as they completed this project skills including information research using both electronic and traditional resources, PowerPoint presentation skills, integration of resources, and communication via email and discussion boards.

Mystery City was used as the EDFN 365 assessment project for the unit on Multimedia applications. The purpose of the project was to engage students in learning with technology and develop confidence in using technology-integrated curriculum. Each team was to choose a South Dakota city to develop as the Mystery City. The team researched information about the city to develop the clues as well as a multimedia presentation about the city. Students had to use sources that K-12 students would have available to them including the Internet, library and textbooks. Preservice students kept a search log which indicated the date of their search, the sources of information, and who found the information. We talked about formulating clues that wouldn't be dead giveaways yet not so difficult that the fourth, fifth and sixth graders wouldn't be able to guess the city.

The preservice students responded by searching information using various sources and discovered interesting facts about their respective cities. Several students were surprised that they couldn't find information on the Internet – they had become so reliant on it! So we had the opportunity to expand our database discussion by referring to the various newspapers resources online around the state. They spent numerous hours gathering information for the project as well as crosschecking information. For example, one of the groups came up with some great clues based on their personal knowledge but they had to be reminded that K-12 students had to be able to find the answer so they spent time verifying their personal knowledge with existing sources.

Once the students submitted their clues for Mystery City, they turned to creating their presentations for class. In class, information about planning PowerPoint Presentations was shared and students were expected to storyboard their presentations. In the final assessment, not only would their PowerPoint presentation be assessed so to would their presentation ability using the PowerPoint as a visual aid and the ability to collaborate with others be evaluated. The presentations were insightful as to how PowerPoint Presentations are perceived. Several groups read their PowerPoint presentations word for word, which doesn't capture the true use of PowerPoint as a visual aid. Several groups however, grasped the importance of PowerPoint as further illustrating the oral presentation by providing a format for visual information. The other interesting event that occurred was the class's freedom to provide additional information to other groups and to even question the sources in terms of reliability requiring students to use higher order thinking skills to pull together their information and answer the questions. And we all learned something new in terms of South Dakota history.

Three groups of EDFN 365 students had their clues chosen for Mystery City. SDSU's EDFN 365 class was responsible for providing clues during weeks five, six and seven. In week five, right away Monday morning we were notified of the chosen city by email and the first clue was posted to the Discover South Dakota website. Group One was asked to check the web site for the students' guesses beginning Monday morning, checking at least twice daily responding to any emails. If there were any emails, the group would read and respond to the students. The group continued checking throughout the week until the answer was revealed on Friday. Group One received several emails during the first day with various attempts from the K-12 students to reason out the correct answer. According to the group, they had some correct answers the first day but they were surprised at some of the answers they received. The group also indicated that K-12 students backed up their guesses with research by citing textbooks they had read. Tuesday's clue helped many K-12 students answer correctly. Overall this group received email each day of the Mystery City project with some great results.

- Monday's clue: What city in South Dakota had the first telephone exchange?
- Tuesday's clue: What town was made famous by the "dead man's hand"?
- Wednesday's clue: What town has a hotel that is supposedly haunted by the town's first sheriff? (1999).

In week six, again we were notified Monday morning as to which clues had been chosen. Group Two, when informed was very excited about participating. This group had personal ties to the city chosen and came up with clues that would get the K-12 students hunting! For their presentation, they had gone out to take pictures with the digital camera so that their clues would be visual as well as textual. We were informed however, that at this time Mystery City would remain textual clues. The group, however, used their pictures in their PowerPoint presentation, which added visual clarity to their presentation. Monday came and went with no guesses. The group had a few guesses on Tuesday and Wednesday but participation in Mystery City was not as high as the previous week. The group speculated as to why they did not have a high participation rate. A couple of reasons may have caused less participation. One reason may be that classes use Mystery City as it fits their schedules so if there were tests or other curriculum requirements used in the classroom, students may not have participated for that week of Mystery City. The group also inquired about the level of difficulty of their clues and thought maybe they could have used other facts they had discovered during their search.

- Monday's clue: The development of the railroad caused the whole town to move from its original location to C.B. Kennedy's Homestead.
- Tuesday's clue: This town was the 1995 South Dakota Community of the Year.
- Wednesday's clue: If you are looking for an exhibit of former Prairie life in South Dakota, this group of 40 buildings 3 miles outside of town will show you what you are looking for, (1999).

In week seven, we were notified Monday morning as to the clues for the week. Group Three began their facilitation of Mystery City. Again this group was very excited about the opportunity to participate. This group had also compiled some interesting facts and figures about the "Mystery City". This group used again personal knowledge coupled with facts and figures available in textbooks and Internet to create their clues. This group also gathered pictures from a local historian and used the digital camera to illustrate one of their clues. They had several guesses on Monday but no correct answers. Tuesday and Wednesday brought more guesses. When the K-12 students guessed the correct answer, this group sent the students a picture of the elephant hunt. Group Three also created some excitement in their town because of their participation – the state championship trophy had been locked in the bank vault for years and my students went to take pictures of it for their presentation. As they were taking pictures, many people that had lived there for years stopped to look at the trophy and hear about their project!

- Monday's clue: What is the name of the town that is located 207 miles from the capital of South Dakota?
- Tuesday's clue: On May 15, 1916, a circus was in town for a couple of days. One day one of the circus elephants escaped from its cage and was loose in town. In order to capture the elephant they were forced to kill it with a gun.
- Wednesday's clue: What is the name of the town that was the first team in South Dakota to win three consecutive State Championship Boys Basketball titles? (1915, 1919-1920, - in 1916, 1917 and 1918 there were no state games because of World War I).

Preservice Technology Opportunities

Mystery City as a project has provided preservice students an opportunity to achieve several objectives within the EDFN 365 classroom and provide a model of telecollaborative to my students. According to recent technology and preservice surveys, students know they will have to use technology in their teaching but their current educational situation focuses on acquiring the skills not the modeling of technology (Deal, 1999). Modeling of technology integration is important for the success of preservice students' implementation of technology in their classroom teaching. This project has given EDFN 365 students interaction with K-12 students using Internet as the only means of communication which has provided additional thought in our classroom about the uses of technology in their teaching. Another outcome that was unexpected was the desire to use pictures as clues. We approached the project leaders about this explaining that my students were developing PowerPoint presentations about these cities. Currently, we are exploring the use of pictures as clues and having the EDFN 365 students publish their PowerPoint Presentations on the project website. Having the students participate in a public project also improves the quality of their work. This semester, many of the EDFN 365 students went far beyond my expectations.

It has real-life relevance, which has excited the preservice students and has inspired a couple of them to think of similar projects that they could incorporate into their own classrooms. One student wrote a lesson plan based on her experience, which she plans on delivering and sharing as she goes into her student teaching. Several of the students in this class are social studies majors and will actually teach South Dakota History –these individuals seemed to look at this project as having possibilities in their classrooms of the future. Students also get an idea of some of the projects that the K-12 students are completing with the use of technology. Besides Mystery City, Discover South Dakota also has space for the K-12 students to publish their work. The EDFN 365 students were amazed at some of the projects these kids are doing from simple web publishing to short movies.

That is what is so exciting about using telecollaborative projects, it provided students a springboard for other ideas that excite and ignite them to use technology as a tool for learning. Several students have indicated that they may continue to participate in projects such as Discover South Dakota because they are aware of the possibilities after their experience. Students suggested activities such as using the same format but using presidents instead of cities. Another group came up with a mystery disease plan.

As several of my groups discovered, they not only have the power to touch their own lives with technology use, but they have reached out to K-12 students, and community members through the project. There are other possibilities of expanding the project to include other technology assignments as well as linking with the Education of Place curriculum that is currently being developed.

Not only does this experience provide students an opportunity to meet the ISTE standards, but also the activity in future will provide students a way to meet their technology graduation requirements. Students attending a state university will be required to demonstrate technology competency upon graduation. As EDFN 365 is a course that goes a long ways to meeting this requirement in the College of Education, the Mystery City project provides a great vehicle for information searching skills, evaluation of information, using technology tools to produce a presentation, communication abilities with email and various other aspects that will meet this requirement

Conclusion

In conclusion, telecollaborative projects provide a link between K-12 and higher education that is beneficial for the preservice teachers and the K-12 students. It provides both with the ability to experience real-life interactions that are exciting. The Discover South Dakota project not only provides a curriculum for school districts, but also helps to structure the Integrating Computers classroom by providing the opportunity to have students create and deliver a technology enhanced lesson. This experience has had a positive influence on the possibilities of technology in teaching, which has been a goal in the class.

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Technology Partners: Preservice Teachers and Students Collaborate to Master Technology Curriculums

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Abstract: Through a field experience in the Fifth Dimension, preservice teachers are acquiring technology competencies required for licensure in the state of North Carolina. This technology rich environment allows observations of numerous learning experiences involving computers and multi-media. Simultaneously, this program offers unique opportunities for children to experiment with educational software and other technology equipment. This paper describes an analysis of both preservice teachers and students and their learning experiences during this program.

Introduction

For years we have conducted research on a learning environment, the Fifth Dimension, that is based in the doctrine that learning and development are cultural-historical in origin (Cole, 1996; Luria, 1979; Scribner & Cole, 1981; Vygotsky, 1978). This view is based on the social constructionist idea that learning is a collaboration of both person and environment (Resnick, Levine, & Teasley, 1991). At our Fifth Dimension sites, children volunteer for a form of play on computers using a variety of multimedia and software. University students enrolled in practicums during their preservice teacher education programs aid children in achieving their goals by participating in setting goals, developing daily objectives, making decisions, and developing strategies.

To enhance the concept of the importance of collaboration of both persons and environments in the context of learning and ultimately teaching for preservice teachers, we have created an after school program using the technological rich learning environment of the Fifth Dimension. Through this program, we have attempted to provide "hands-on" experiences in which play, education, peer interaction, and affiliation are deliberately mixed while using technology as a tool. We have demonstrated that participants in this program achieve higher levels on tasks in which they engage (Nicolopoulou & Cole, 1993), acquire proficiency in using technological tools in the process of attaining personal goals (Schustack, King, Gallego, & Vasquez, 1994), and that special education students who participate in the Fifth Dimension progress in the same manner as their regular education counterparts, with similar success (Zimmerman & Blanton, 1993).

Preservice teachers participated in this after school program as part of a field experience during a class, "Teachers, Schools, and Learners." While preservice teachers are participating in this technology rich environment, they are acquiring technology competencies required for licensure in the state of North Carolina. The environment also allows for the preservice teacher to observe numerous learning experiences involving computers and multi-media and the learning that takes place during these tasks. Simultaneously, the program offers a unique opportunity for children in grades kindergarten through sixth to experiment with educational software that refines technology skills that are a part of the state's standard course of study.

Technology Competencies for Preservice Teachers and K-8 Students

In 1994 a Task Force was established to recommend educational technology initiatives which would eventually encompass the total North Carolina Educational system. This Task Force created a list of technology competencies for inservice teachers, teacher education faculty, and preservice teachers in the state. Each institution of higher education was given authority to devise and implement a technology program for their preservice students and teacher education faculty. Preservice teachers must now demonstrate competencies on basic technology skills and develop technology portfolios demonstrating competence on advanced skills.

The basic technology competencies defined by the task force include skills and knowledge in the areas of: Computer Operation; Setup, Maintenance, and Trouble Shooting; Word Processing and Introductory Desktop Publishing; Spreadsheets and Graphing; Databases; Networking; Telecommunications; Media Communications including Image and Audioprocessing; and Multimedia Integration. Advanced competencies include: Curriculum; Subject-Specific Knowledge; Design and Management of Learning; Child Development, Learning, and Diversity; Social, Legal, and Ethical Issues. Verification of competence in advanced areas must be demonstrated in a portfolio format. These competencies may be found on the North Carolina Department of Public Instruction web site: http://www.dpi.state.nc.us/tap/techcomp.htm.

All eighth grade students in the state of North Carolina are tested on computer skills. The computer curriculum for the state may be found on this web site: www.dpi.state.nc.us/testing/#curr . This curriculum consists of nine strands: keyboarding; word processing/desktop publishing; telecomputing; database; spreadsheet; societal issues; ethics; computer terms, operation and care; and independent curriculum software use.

Web Site Database

In order to observe the impact of this experience on preservice teachers a web site was created to hold a database of student biographies, fieldnotes from the after school Fifth Dimension sessions, and preservice teacher attitude surveys. This web site: http://www.ced.appstate.edu/intercollege/2800 is a place for preservice teachers to write fieldnotes about their experiences in the Fifth Dimension. General observations and experiences are described and are accessible to preservice teachers and their professors in the sections of "Teachers, Schools, and Learners" that correlate with the Fifth Dimension experience.

Fifth Dimension

About seventy-five percent of the activities in the Fifth Dimension use computers and telecommunications, including educational software, computer games, telecommunications activities for searching the Internet, and tools for computer-mediated and video-mediated conferencing. Subject matter covers the traditional school curriculum and includes communication skills, math, social studies, health, science, technology, and the arts, all with an emphasis on problem solving. Over 120 educational computer games such as "Carmen San Diego", "The Amazon Trail", "Dino Park Tycoon", Opening Night", "Lego Logo", are used in this program. Other technology tasks include Internet searches, digital cameras, and video conferencing equipment.

Analysis

An examination of preservice teacher fieldnotes was completed. Common themes were found. Many comments were made as general site observations discussing the setting and apprehensions about dealing with a new educational environment. One such statement:

> *When I walked in today it was real quiet again and the doors in the hall were closed. In the computer lab all of the interns were in there working on the games. As we had said in class, we all were not sure about the games and felt like we did not know what we were doing. As Stephen and I walked down the hall he said that he was going to go in and work on games until it was time to get our kids. Well, everyone else was doing the same thing. I guess we all are on the same level and worried about what we are doing. Interesting!*

Another common theme to fieldnotes dealt with technology. Preservice teachers may have been exposed to technology as students and they may have been told about educational uses, but until this experience, they may not have observed first hand how technology can be applied to learning. The following entry illustrates the virtues of telecommunications and the inspiration for further learning in technology.

> *In this course, I find the telecommunications that we set up with UCSD to be very interesting and exciting. It allows me to interact with fellow students across the country. Through these telecommunications, I am able to learn about how their Fifth Dimension operates , as well as their classroom. From this class, I am finding that it is a challenge to learn all of today's technology and how it operates.*

Comments from other preservice teachers included feelings of ignorance, although very little despair, about computers.

> *The whole idea of the lab amazes me. I think it is a wonderful way for the children to learn and for us to learn also. Also, the technology that comes with this class is incredible. I am very "dumb" when it comes to computers so this class will definitely be a challenge for me.*

Others wrote that they were excited about the technology aspect of the Fifth Dimension, especially with students who are computer literate.

> *I am interested in learning how children work with technology since many of the students were practically brought up in the computer era.*

A large part of fieldnotes included reflections on the learning process,

> *I am convinced that when a child sees something more than once she will learn it well and know how to do it.*

> *I was reinforced that children learn after seeing things more than once and that they can do things faster after they get it into their brain as to what they are doing.*

the social-constructivist environment,

> *I enjoy working on computers and being able to go through the Fifth dimension program with the children, not teaching the children, but learning together as we go will be very rewarding.*

and motivation.

> *I learned that they look up to us as older role models, and it is us that motivates them along with their peers.*

> *That some get more excited than others about achieving but if the intern gets excited with them it will motivate them more.*

To better understand how classes, that corresponded with field experiences in the Fifth Dimension, met technology competencies with preservice teachers, four professors of these classes were surveyed. Professors answered that they used email, required assignments to be word processed, used web sites to down load articles, required students to subscribe to listservs, taught skills for multimedia presentations, and introduced the state's technology competencies. One section of the basic technology competencies is computer skills operation. In the Fifth Dimension, preservice teachers along with their student partners complete many of these such as:

1.1 Start up and shut down computer system and peripherals
1.2 Identify and use icons, windows, menus
1.3 Start an application and create a document
1.4 Name, save, retrieve, revise a document
1.5 Use printing options

Some of the professors gave more specific information that can be connected with advanced state technology competencies. One professor wrote that she encouraged students to find articles on the web relating to special education, which corresponds with an advanced competency in "essential knowledge and skills":

> 13.4 Use appropriate local, state, and national services or resources to meet diverse learning needs through technology.

Another professor encourages the use of technology in class presentations which meets a requirement under advanced essential knowledge and skills:

> 12.3 Use computers and other technologies effectively and appropriately to communicate information in a variety of formats on student learning to colleagues, parents, and others.

All four professors were practicing the integration of technology in their courses. Positive attitudes toward integrating this technology accompanied the descriptions of their use.

Conclusions

After North Carolina adopted technology competencies for licensure, colleges of teacher education throughout the state scurried to meet the needs of preservice teachers. Faculty at institutions of higher education were offered training in technology and encouraged its integration, when appropriate into their classrooms. It was felt that skills alone would not prepare new teachers for the technology challenge. Technology must be modeled in order to foster positive attitudes and encourage appropriate use in public schools.

The Fifth Dimension has provided a "hands on" technology and learning experience that corresponds with a class on "Teachers, Schools, and Learning". Initial exposure to state technology competencies may be obtained in this setting. Many of the basic and advanced competencies could also be completed in the Fifth Dimension.

Most preservice teachers in our program gained an insight into the value of technology in education. Fulfilling state requirements was seen as an added bonus during the Fifth Dimension. Achieving an understanding of children's learning processes, being involved in a social-constructivist learning environment, and gaining hands-on knowledge of student behavior early in a teacher education program were reported as valuable experiences by our preservice teachers. Overall, this program was highly successful in these areas and hopefully will continue to provide a model for teacher education programs.

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Four Year Collaborative for Preparing Teachers to Use Technology

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Abstract: The Class Act Preparing Tomorrow's Teachers to Use Technology project is a four year teacher preparation program that utilizes technology as a tool for the delivery of instruction as well as an integral part of the teacher preparation program skill development for the beginning teacher candidate. The program is composed of students who apply for admission to a community college, complete a field based teacher education focused year one and two program followed by a competency based technology enhanced professional program at the University. The program reflects a learning community technology linked professional development model.

INTRODUCTION

National Teacher Preparation Needs

The role of the teacher is becoming more complex. Teachers are being asked to learn new methods of teaching, while at the same time they are facing the greater challenges of rapidly increasing technological changes and greater diversity in the classroom aggravated by societal issues outside the classroom related to poverty, crime, and family dysfunction. In a recent survey on the quality of teacher preparation, it was reported that less than half of American teachers reported feeling "very well prepared" to meet many classroom challenges:

> though educators and policy analyst consider educational technology a vehicle for transforming education, relatively few teachers reported feeling very well prepared to integrate educational technology into classroom instruction (20 %)
>
> 54 percent of the teachers taught limited English proficient or culturally divers e students, and 71 percent taught students with disabilities, relatively few teachers who taught these students felt very well prepared to met the needs of these students.
>
> 28 percent of teachers felt very well prepared to used student performance assessment techniques; 41 percent reported feeling very well prepared to implement new teaching methods, and 36 percent reported feeling very well prepared to implement state or district curriculum and performance standards. (National Commission Report on "The Demands of Current School Reforms, 1996)

According to the National Commission on Teaching and America's Future (1996), the demand for teachers in the next two decades will increase substantially. Statistics that underscore this urgency are a combination of societal and teacher force demographics. Higher birth rates and immigration have caused the teaching force to grow from 2.5 million in 1980 to 2.8 million in 1991. It is projected that by the year 2002, we will need over 3.3 million teachers to meet the need for educators to fill positions to meet the growth in student populations. Concurrently, our present teacher work force is at a point were large numbers of experienced teachers are near or at retirement. The commission reported that nearly one fourth of the teachers in America in 1991 were over 50. Over the next decade, more than 200,000 teachers will need to be hired annually. The dramatic change in the teaching force presents an opportunity to influence educational reform via the preparation of a new teacher professional. An individual who understands learning theories, has the ability to address the needs of a divergent student population, can prepare student focused lessons that encourage knowledge creation and creativity in a technology rich community based learning environment.

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National Response to Teacher Preparation

National Education Goal 4: Teacher Education and Professional Development

> By the year 2000, the nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire the knowledge and skills needed to instruct and prepare all American students for the next century.

National Education Goal number four, provides evidence of the national level recognition for the improvement of the initial and continuous preparation of teachers. Teacher's for today and tomorrow's schools will need skills and understandings which allow them to teach all students for understanding by in depth understanding of subject matter, a sensitivity to divergent learning styles of students, and the ability to successfully design instruction that takes advantage of constructivist, student centered, technology rich learning environments.

While there are many ingredients for successful school reform, it all comes down to the classroom teacher. Indeed, the success of the entire school reform movement is dependent upon teachers acquiring the skills, perspectives and knowledge necessary to transform the learning of all students. However, because we only now fully appreciate the ways of teaching complex subject matter to diverse students, many of our current teachers remain under- or unprepared. Insufficient or inadequate preservice and inappropriate or incoherent in-service teacher education retard the effort to realize the National Education Goals.
(Teacher Education and Professional Development National Education Goals Panel, July 1995)

A reform of teacher preparation is precursory to reform in public schools in America. Public attention has been focused on the reform of elementary and secondary schools without attending to the preparation of the teachers who will work in these schools. While there are many ingredients for successful school reform, it all comes down to the classroom teacher. The success of the entire school reform movement is dependent upon teachers acquiring the skills, perspectives and knowledge necessary to transform the learning of all students. With an estimated need for two million new teachers over the next decade to replace retiring teachers and to meet increased student enrollment, well-designed teacher education programs are a critical factor in reforming our schools. Reform includes the need to create a technologically literate teaching force to meet the demands of society. Because of this, the integration of technology should be accomplished in relation to other efforts to reform teacher preparation, not as a separate reform initiative.

Minnesota Teacher Preparation Needs: P-12 Graduation Standards Change the Instructional Expectations

Consistent with the national need for qualified teachers, rural Minnesota faces a challenge in recruiting, training and retaining teachers. Teachers are needed who can address the curricular expectations for Minnesota schools. Recently, the Minnesota legislature mandated comprehensive performance-based Graduation Standards for all students. These standards will require students to show competency in critical areas such as communications, inquiry based learning, problem solving citizenship and technology. Imbedded in the Graduation Standards is the requirement that all students have an in-depth working understanding of personal computers and commonly used software, and be comfortable using electronic means to conduct research and analyze results. Not only will Minnesota need to recruit qualified teachers, but these teachers will also need to be trained to guide students in the use the technology available and to demonstrate their knowledge of the graduation standards in an observable, performance based environment.

Minnesota Licensure Requirements Change to Require Competency Based / Technology Enhanced Teacher Preparation Programs

In response to the changing demands of the role of the educator in Minnesota, the Minnesota Board of Teaching, which is responsible for overseeing teacher education has revised the way it licenses teachers. This new teacher licensing structure will be a competency-based system rather than one which grants a teaching license based solely on completing designated academic courses. The competencies which will be used in this new structure must be based on the standards delineated by the Interstate New Teacher Assessment and Support Consortium (INTASC). For the first time, teacher preparation competencies address the development of constructivist teaching strategies supported by instructional technology resources. In addition to the Minnesota Board of Teaching requirements, the February 1999 draft of the National council for Accreditation of Teacher Education standards for accreditation of teacher education program identifies both the INTASC standards and also lists a specific competency which addressed candidates ability to effectively integrate technology into their instruction. Minnesota Colleges and universities responsible for educating future teachers are required by both state and national accreditation boards to implement a performance based, technology enhance, student centered teacher education programs. This new profile for licensing teachers goes into effect August 1, 2001.

Though Minnesota has a history of educational excellence, a number of challenges face Minnesota schools, most urgently : how to recruit and train enough educators to meet the increasing demand, and how to improve all students' capacity to meet high academic standards. Gerald Christenson, former chancellor of the Minnesota Community College System writes "Our increasingly complex society will require teachers who can deal successfully with change, who are prepared to use new technology and who can recognize that children learn in many different ways" (Christenson).

Class Act Preparing Tomorrow's Teachers to use Technology (Federal PT3 Implementation Grant Awardee): A Response to Reform in Teacher Preparation

PT3 Class Act Project, augments a four year competency based, technology focused teacher preparation program "Class Act" in Northern Minnesota. Class Act was created by a collaborative which included two Universities, a Community College, School Districts, and a private Foundation. The project has two cohorts of preservice teachers who will complete their first two years of preparation at a Community College with a teacher preparation flavor in their liberal studies courses as well as continuous placement in community and public school placements. Students will then transfer to the University for their final two year professional coursework. During their final two years the PT3 Class Act students will be placed in technology enhanced field based placements .

Learning to teach to the identified skill needs of the community and the diverse student population are central Class Act Program objectives. The region's demographics reflect a rural, sparsely populated, low income area. The heritage of the region includes a high Native American population. Research indicates that visual, auditory, inquiry based instruction facilitated by effective use of instructional technology instruction enhances the academic achievement and motivation for all students and in particular Native American students.

The PT3 project will prepare teachers who can deliver inquiry, application, technology rich instruction. To participate as a Class Act student, an application process was completed. The process consisted of a written application, letters of reference, and individual interviews. Those selected, while at the Community College complete typical associate of arts course work. However, the curriculum was modified with an education preparation and issue focus. In addition to the on campus coursework, Class Act students participate in teacher preparation practica that encourage applied contextual, technology-enhanced learning. Participants are placed in both education and community/business based practica from the first semester of their freshman year continuing throughout the completion of their baccalaureate degree.

The following PT3 project examples, document the activities which will be used in the Class Act program to teach effective integration of technology into instruction. The first example is the distribution of lap top computers to Class Act students for use throughout their four year preparation.

Linkage Labs / Tec to Take Kits

Another example are Linkage Labs. Linkage labs are technology enhanced learning environments located regionally to support the instructional technology skill development for preservice, mentor teachers and higher education faculty. Linkage Lab inservices directly relate to the instructional applications for "Tec to Take" kits. Tech to Take "kits" are sets of technology resources that the preservice teacher can take to the field based practica. The Tech to Take kits will insure that the resources for effective technology enhanced instruction are available at the field site. One of the outcomes of Linkage Lab inservices will be the development of technology rich lessons which take advantage of the Tech to Take kits. Preservice teachers, classroom mentors and higher education faculty work in learning teams to create and plan practica where the innovative lessons can be taught.

TEACH Web Site Internet Resource and Communication Component

Another example comprehensive technology support resource for the project is a web crossing discussion forum and resource internet site http://TEACH.bemidji.msus.edu. The TEACH web site is monitored by education experts who facilitate and expand the topics and links for the site based on the needs identified by site users. Another aspect of the TEACH site is the ability to access state and national education experts "master mentors". The "master mentor" feature provides participants direct access to leaders in the field who can answer educational questions in an anytime anywhere internet environment.

Summary

In summary, the overall objective of the Class Act PT3 project is to refine a teacher education program that reflects national teacher education exemplary practice. The curriculum is competency based, field site focus, and collaboratively supported by school, community and institutions of higher education. The PT3 resources will strengthen the technology focus of the curriculum, expand the school and higher education participation, and contribute to the support of instructional technology resources.

During the next three years, the project consortium will continue to refine and expand the implementation of the Class Act PT3 program. The overall goal of the project is to develop a collaborative model for teacher preparation that uses technology as a critical infrastructure for the delivery and modeling of quality instruction. The final outcome goal is to develop educators who have a philosophy that reflects quality student centered instruction that fosters student achievement and supports life long learning for the student and the professional educator.

Scholarship, Technology, and Educational Practice (STEP): Creating Partnerships That Renew Preservice Education

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Abstract: This paper describes a current project funded through the U.S. Department of Education's "Preparing Tomorrow's Teachers to use Technology" initiative. The need and issues related to integrating technology into the preservice program, as well as early models that led to the current project design, are discussed. STEP creates a model of partnership between schools of education and K-12 school districts that prepares preservice teachers to be effective users of technology. Collaborative teams of methods teachers and K-12 teachers will work together to integrate and model technology tools in the preservice curriculum. These educator-teams share responsibility for developing and modeling teacher preparation strategies that incorporate technology tools. Through this project, preservice students observe and interact directly with K-12 master teachers to learn effective teaching strategies that incorporate technology.

Need

Technology increases the availability of information and provides powerful new tools for constructing meaning and creating new knowledge. Furthermore, standards for personal and professional success will in future be predicated on the ability to use technology tools confidently and competently to foster continued intellectual growth. Students must start now to instill effective learning strategies that incorporate technology tools, and it is imperative that students have teachers who can guide them in developing these strategies. Tomorrow's teachers must also be confident and competent users of technology tools: they must be skillful in designing, implementing, and evaluating effective learning environments that utilize these tools. According to Sheingold (1991), it "is unlikely that the ambitious goals for learning and teaching can be met without widespread, creative, and well-integrated uses of technologies of many kinds" (p. 22). This need is felt particularly in Nebraska, where the majority of the state is rural, and where there exist a significant number of low-income communities. Nebraska's rural and low-income communities need teachers who can help students use technology to supplement the scant educational resources commonly available in these areas.

However, the majority of faculty members teaching in Nebraska's teacher preparation programs do not integrate instructional technology into their courses, nor do they model effective teaching strategies that incorporate technology. Preservice students, as a consequence, do not learn about the role of technology in education, and they do not practice the use of technology during field experiences.

Nebraska faculty members reflect a national trend in the use of instructional technology in preservice training programs. In 1999, the International Society for Technology in Education (ISTE) was commissioned to conduct a survey of Schools, Colleges, and Departments of Education (SCDEs). The results of this survey finds that faculty members have access to technology and can use technology tools for communication and personal productivity. However, the survey also finds demonstrations of effective teaching strategies that incorporate technology neither are modeled in the classroom nor are required of students as part of their field experience or course requirements. Persichitte, Tharp, and Caffarella (1997) report that "actual utilization and contextualized integration of these technologies within personal and workplace settings, for both SCDE students and faculty, is far from commonplace within SCDEs." In 1998, the South Central Regional Technology in Education Consortium (SCRTEC), conducted a regional survey, including Nebraska, that concludes: "Our institutions of higher education are still internally focused on their technology needs and are not yet able to really focus outwardly on training preservice teachers in the best uses of technology . . . ". Further supporting these findings, Sutton (1997) conducted a survey of all methods faculty members at Nebraska's institutions for teacher preparation:

> "The data revealed that most Nebraska methods instructors were using some form of instructional technology. However, fewer, only 58%, were requiring their students to use it. In addition, the majority of Nebraska methods instructors were not familiar with the ISTE [Recommended Foundations in Technology for All Teachers], and therefore were most likely not incorporating any of the standards into their teaching."

Several recent surveys, including the ISTE sponsored "Will New Teachers Be Prepared To Teach In A Digital Age?", point to the need for systemic changes in the way preservice students learn about and use instructional technology. First, effective teaching strategies that incorporate technology must be integrated and modeled in preservice education. Second, students must demonstrate as part of their college courses that they understand and can design effective teaching strategies that incorporate instructional technology. Third, students must be given opportunities to observe and interact with master teachers who use technology tools to support teaching and learning.

Finally, faculty members at teacher preparation institutions must be responsible for creating and disseminating models for change in preservice education. This responsibility reflects the reciprocal relationship of research and practice: faculty members need to "identify, study, and disseminate examples of effective technology integration that reflect the current needs in both teacher education and K-12 schools" (ISTE, p. 3, 1999).

Addressing the Need—Past Projects

In 1998, Teachers College of the University of Nebraska-Lincoln (UN-L) was awarded funding through the Eisenhower Professional Development Program for a proposal entitled "Nebraska Educators' Summer Technology Training Institute (NESTTI)." The goal of NESTTI was to ensure that preservice students were provided meaningful opportunities to learn about and use instructional technology in their preservice coursework. However, both national and statewide surveys indicated that faculty lacked time and support to integrate technology into existing preservice courses. Further, these surveys indicated that teacher preparation faculty would benefit from examples of pedagogically sound uses of technology to help them recognize how technology can support preservice curricula. The method for achieving this goal was to immerse faculty in training and modeling activities that reflected sound educational uses of technology. The expectation was that a residential training "camp," with extensive technical support provided, would help ameliorate the issues of time and support. The objective of this training and modeling was to enable faculty members to model the use of instructional technology in their classrooms and to provide opportunities for preservice students to use technology tools as part of their course work.

Methods instructors were selected as the target audience for the project because of their direct role in guiding students to make connections between teaching practice to learning theory. Methods instructors from across the state were invited to participate in a weeklong, residential summer training session at UN-L. Training and modeling activities for the session were based on the content areas of the participants. Attendees were immersed in classroom-oriented uses of technology, and extensive technical support was provided throughout the learning process. Attendees learned how to use software titles that were representative of "genres" of technology tools (e.g., HyperStudio for multimedia applications). But more importantly, participants were introduced to these tools during modeling sessions by K12 teachers and higher education faculty. Through these modeling sessions attendees participated directly in using technology to facilitate learning. These opportunities for connecting technology tools to learning objectives helped participants make connections between technology and their own teaching practices.

Follow-up activities were scheduled throughout the academic year, 1998-1999. The participants themselves generated topics for these sessions and were well attended. During these sessions, participants received additional training, were able to ask for specific technical support to solve problems, and had the opportunity to share their work with their colleagues.

Data collected during the first year revealed that most participants had made significant progress in integrating technology into their methods courses as a result of their involvement with the NESTTI project.

However, it was recognized that the original NESTTI proposal would have a more long-term potential if participants were given more time to develop multiple products for use in their courses. Furthermore, the first year participants commented that the one-week approach had not left enough time for reflection, a process necessary for developing meaningful projects and products. Consequently, the original NESTTI proposal was rewritten to address this need, and UN-L received a second grant award from the Eisenhower Professional Development Program in 1999. The second year of the NESTTI project followed the same format as the first year with two notable exceptions. First, the training/modeling session was held over a two-week period. Second, participants read selected research articles related to instructional technology, which provided the basis for highly engaged discussions related to the participants' conceptions of and uses for technology. This second year of NESTTI is still ongoing, and results will be available in fall 2000.

Addressing the Need—Current Project

The NESTTI approach has proven very successful, and has served as a useful first-step in faculty professional development related to instructional technology. However, it is recognized that this approach can be improved upon. Training and support for any faculty development project should be immediate and ongoing, not periodic throughout the year. Moreover, learning activities should relate to specific course needs and individual teaching styles of participating faculty in order to be of most benefit to the participants, not generic modeling exercises. Ideally, integrating instructional technology into preservice courses would become part of an ongoing process of renewal in preservice education, and technical support would be provided as a means of facilitating what instructors are already doing in their classrooms.

In 1999, the University of Nebraska-Lincoln and the University of Nebraska-Kearney received a grant award from the U.S. Department of Education as part of the "Preparing Tomorrow's Teachers to use Technology" initiative. This project, entitled "Scholarship, Technology, and Educational Practice (STEP)," is designed specifically to improve upon the NESTTI approach to faculty development and top the improvement of preservice education. This project creates an effective model that supports continuous renewal of teaching content and strategies in preservice education related to instructional technology. Through this project, partnerships are established between methods faculty members and K-12 teachers for integrating and modeling teacher preparation strategies that incorporate technology tools. Furthermore, this project creates meaningful opportunities for preservice students to observe and interact with K-12 teachers who use technology tools in their classrooms. Most importantly, preservice students in this project will work directly with K-12 teachers in developing teaching strategies and materials for use in the teacher's classroom. This project will prepare tomorrow's teachers to design, implement, and evaluate classroom environments in which children learn with technology.

Goals

This project creates a model of partnership between schools of education and K-12 school districts that prepares preservice teachers to be effective users of technology. The project has four goals. First, this project will establish a process for collaboration between teacher preparation faculty members and K-12 teachers. Through this collaboration, faculty members and teachers will share their respective expertise in research and practice for mutual professional development. These educator teams will jointly develop and model teacher preparation strategies that incorporate technology into the preservice curriculum. Second, this project will establish a process for creating authentic learning opportunities for preservice students in which they observe and interact with K-12 teachers to design, implement, and evaluate teaching strategies that will be used in the K-12 classroom. Preservice students will be challenged to examine their own behavior and the practices of their cooperative teachers, learning how scholarship and practice inform and build upon one another. Third, instructional technology training and technical support will directly support the needs and learning objectives established by the faculty members, teachers, and preservice students. Technical expertise will be shared and coordinated to support participating members and project activities, and technical staff will be given opportunities for continued professional growth. Finally, this project will ensure that teachers who fill positions in rural and low-income areas have the skills and knowledge to use technology effectively to overcome the scarcity of educational resources found in these areas.

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Objectives for the Project

This project will impact a significant number of preservice faculty members and preservice students over three years. The project will include 20 methods faculty members and at least 20 K-12 teachers. This project will directly impact approximately 1020 preservice students.

1) Increase the number of preservice students using technology tools to support teaching and learning.
2) Disseminate resources, activities, and teaching strategies that integrate technology tools into preservice education programs.
3) Disseminate a collaborative model between higher education and K-12 to evaluate and improve preservice education experiences using technology tools.

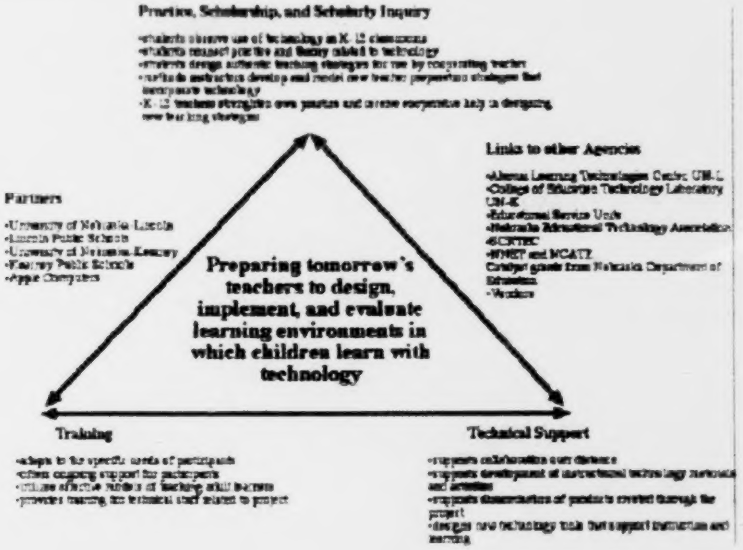
Comprehensive Effort

This proposal describes a broad and inclusive vision for improving preservice education. This project is based on a scholar-practitioner model, which forms a framework for student learning in the preservice program. Through this model, faculty members and teachers are jointly responsible for guiding preservice students as they build connections between scholarship and practice activities. Students interact in field settings in which they can inquire about and reflect upon the use of instructional technology, and how instructional technology affects their own work as educators. The scholar-practitioner model ensures that the goals, objectives, and activities of this project are based on best practices and on scholarly literature.

Furthermore, this proposal couples collaborative activities with ongoing training and technical support to create a comprehensive model for integrating instructional technology into preservice education. The proposal comprises three interrelated functions:

- Practice, Scholarship, and Scholarly inquiry
- Training
- Technical Support

The diagram below helps visualize the relationship of these three components. Each component forms one corner of a triangle, with arrows indicating their reciprocal relationship:


Practice, Scholarship, and Scholarly Inquiry
•students observe use of technology in K-12 classrooms
•students connect practice and theory related to technology
•students design authentic teaching strategies for use by cooperating teacher
•methods instructors develop and model new teacher preparation strategies that incorporate technology
•K-12 teachers strengthen own practice and [illegible] in designing new teaching strategies
Partners
•University of Nebraska-Lincoln
•Lincoln Public Schools
•University of Nebraska-Kearney
•Kearney Public Schools
•Apple Computers
Links to other Agencies
•[illegible] Learning Technologies Center, UN-L
•College of Education Technology Laboratory UN-K
•Educational Service Units
•Nebraska Educational Technology Association
•SCRTEC
•ISTE and NCATE
Catalyst grants from Nebraska Department of Education
•Vendors
Preparing tomorrow's teachers to design, implement, and evaluate learning environments in which children learn with technology
Training
•adapts to the specific needs of participants
•offers ongoing support for participants
•utilizes effective models of teaching adult learners
•provides training for technical staff related to project
Technical Support
•supports collaboration over distance
•supports development of instructional technology materials and activities
•supports dissemination of products created through the project
•designs new technology tools that support instruction and learning

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TEACHING THE USE OF INFORMATION IN A TECHNOLOGY FRAMEWORK

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Abstract: This paper is a summary of procedures used to design and implement an undergraduate course for all entry level students in the College of Education. The question asked: What do pre-service teachers need most in a teacher education program that will effectively prepare them to meet the demands of the 21st Century classroom? The answer is apparent: effective methods of teaching the use of information using a technology framework. The answer to this query was the genesis of a course designed for entry level students in the College of Education that met three unique features: 1) individual student flexibility in selecting research projects and technology tools; 2) collaboration among faculty and students in presenting research strategies and investigating current themes in education; and 3) empowering students with self management skills that prepare them for lifelong learning. This approach successfully presented applications of information, utilizing a technology framework. The conclusion indicates that higher education is improving the learning experience of college students.

Introduction

Teacher education institutions have the opportunity to prepare pre-service teachers to be effective users of information and its accompanying technology. The National Council for Accreditation of Teacher Education (NCATE, 1997) described the vision needed for teacher education programs in the 21st Century classroom to include full utilization of information technology. The American Library Association stressed the importance of information literacy in its new national standards and defined it as the ability to seek and effectively utilize information sources, including knowledge and how to use technologies. (ALA, 1998). Changes in society and technology have resulted in massive changes in education. Learners look to their schools for information beyond academics. This growth in information and technology has precipitated the creation of a community of lifelong learners. Information literacy is at the core of lifelong learning (ALA, 1998). OAT (1995) recognized that technology in all of its applications is still underutilized by many teachers. A band-aid approach following a training program has not been effective. Something different is warranted.

The Course

In the process of preparing 200,000 new teachers annually (President's Committee of Advisors on Science and Technology, 1997), colleges of education have turned to a comprehensive and systematic approach to curriculum redesign that starts upon entry. Towson University has taken a direct approach to addressing the obvious problem of little or ineffective research, technology and curricular integration skills used by pre-service teachers. New students beginning the teacher education program were introduced to a curricular model that focused on best practice in teacher education literature, and included information, research, technology and collaboration.

One of the initial steps taken by the College of Education was to require all entering majors to take a course entitled *Using Information Effectively*. This course was introduced to all freshmen and transfer students and focused on techniques useful for research investigation, connectivity, collaboration, productivity and integration. The purpose of the course was to introduce students to techniques for gathering, evaluating and communicating information using a variety of resources and

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educational technology. The course emphasized team collaboration and problem solving techniques to examine current themes and issues in education.

Faculty collaborated on the design of the course, course requirements and assessment criteria and produced a common syllabus for all classes. The main library cooperated by releasing the services of reference librarians to serve in course planning and team teaching. Technology experts from the university's Computer and Network Services joined the team as consultants. The course components included:

- Team Collaboration
- Connectivity
- Team Teaching
- Resource Experts
- Productivity
- Information Evaluation
- Technology Integration
- Portfolio Design & Assessment

The first two sections were taught in the spring of 1997. Twenty students were in each section. The instructors met weekly to discuss the problems, progress and successes noted in the course. A summary of those sessions revealed: inappropriate placement of instruction; too much content covered in specific units; additional lab time needed for students with little experience using technology; the need for more communication between team leaders and faculty; closer guidance in the selection of team projects; and careful explanation of the criteria and expectations for individual and team projects. All of these changes were made before the start of fall 1998. Sixteen sections of this course are currently being offered during the spring 2000 semester.

The Facilities and Resources

The College of Education has supported the integration of technology into the curriculum. It has been one of the dean's top three priorities for the past five years. Funds were made available to equip two PC electronic classrooms each with 31 Dell Optiplex Workstations, Windows 98, SPSS 8.0, and Inspiration 5.0, KidPix Studio Delux, and Hyperstudio 3.2; one MAC classroom with 25 Macintosh G3 workstations with standard configuration; one computer lab with 22 Gateway P-120 workstations, Windows 95, Inspiration 5.0, KidPix Studio, and Hyperstudio 3.2; and one multimedia lab and an assistive technology lab. One additional MAC lab will be going online in fall 2000. Hawkins Hall, which houses the College of Education, is networked and supported by the university. Education faculty has access to a two-way fiber optic distance learning classroom and a compressed video lab. The building is wired for connectivity, which allows Internet access in classrooms. A network administrator and a technical support staff person hired by the College of Education, maintain these areas.

Standard Software for
Windows Based Computers

- Microsoft Office 97
  Includes:
    Word
    PowerPoint
    Excel
    Access
    PhotoEditor
- FrontPage 98
- Internet Explorer 4.0
- Netscape Communicator 4.61
  Includes:
    Navigator

Standard Software for
Macintosh Computers

OS 8.0

Microsoft Office 98
Includes:
Word
PowerPoint
Excel

ClarisWorks 4.0
ClarisImpact 2.0
FrontPage 1.0

Netscape Communicator 4.61

  - Composer
  - Messenger
- Adobe Acrobat Reader 3.0
- Quicktime 3.0
- Real Player
- Shockwave and Flash
- PowerTerm
- Telnet
- WS_FTP
- McAfee 4.0
- Toolbook II Publisher 5.0

Includes:
  Navigator
  Composer
  Messenger

Adobe Acrobat Reader 3.0
Quicktime 3.0
RealPlayer
  NCSA Telnet
  Fetch 3.0
Virex
  Hyperstudio 3.1
  KidPix Studio Delux
  Inspiration 5.0

Information technology is essential in our framework. Stephen C. Ehrmann's (1998) perspective on technology in higher education reminds us of the importance of breaking ranks with the traditional. His view resembles a four-level tower with each level more sophisticated than the one below it. The basement level contains traditional technologies (textbooks, audiovisual materials), and the infrastructure for their use (libraries, labs, etc.). These basic elements support the four traditional pedagogues on the first floor: directed instruction (lecture halls and textbooks), learning by doing (labs, typewriters, libraries), real-time conversations (seminars, office hours), and time-delayed exchange (homework). The second floor houses enhancements to these practices that require students to use instructional technologies. Finally, the third floor represents large-scale structures supporting new educational concepts. Successful integration of technology into college appears to hinge on the willingness of faculty to move beyond the basement and first-floor technologies with which they are most familiar and move into the upper levels that incorporate information technology.

That is precisely what the faculty did. Those who needed additional expertise in course design worked with instructional designers in the university's Center for Instructional Advancement and Technology (CIAT). Two instructional designers, a graphic artist, and a support staff provide easy access to resources for faculty. Currently the institution is supporting training for faculty from across the university to learn a web-based application for designing courses. *CourseInfo* by Blackboard will be used to put 50% of the course *Using Information Effectively* on the web in spring 2000. Five faculty from the College of Education are participating. Those faculty who needed knowledge in computing, databases, spreadsheets, presentations, publications, word processing, the Internet, and project management, registered for workshops provided by the CANS (Computer and Network Services) Technology Center.

It is an indisputable fact that faculty bear the major responsibility for student learning (Davis, 1993). The public has been very vocal in demanding improved student outcomes. One of the methods used by the College of Education to improve student learning is to improve college teaching. Several faculty development initiatives have been implemented to promote the development of expertise in teaching: CIAT, CANS, VICTORWeb (Online Public Access Catalog), and Mircosoft Network.

The Model

Collaboration, research, information technology and assessment are the cornerstones of this model. This model pairs teaching faculty with librarians: each an essential member of the team. It is very challenging to examine the relationship between college faculty and librarians. The proliferation of information sources and educational technology have created a dysfunctional relationship between college faculty and librarians that is based on an outdated teaching/learning paradigm (Tompkins, 1996). Traditionally, teaching has been the purview of faculty, while librarians were viewed as merely custodians of printed information resources. In the current Information Age however, librarians have become the primary instructors to teach research methods and critical thinking skills as applied to information access. There is support for librarians to be seen as key instructional team members and as partners with faculty.

Over the past 20 years, librarians have worked hard to move from teaching isolated library skills to teaching integrated information skills. Effective integration of information skills has two requirements: 1) the skills must directly relate to the content area curriculum and to classroom assignments and 2) the skills need to be tied together in a logical and systematic information process model (Eisenberg, 1996). Successful integrated information skill programs are designed around collaborative projects jointly planned and taught by faculty and library professionals.

In this course, the team agrees upon the goals and objectives. Instruction is planned, follow-up activities identified, homework criteria discussed, team and individual projects assigned and assessment built into each component. Collaboration between faculty and librarian is essential. In addition, there is collaboration between instructors and students as well as between team members. Connectivity on and off campus involves: tele-mentoring, e-mailing assignments, using list-serves, web-based forums and electronic bulletin boards; accessing VICTORWeb, and the World Wide Web and using management strategies to maintain electronic files for portfolio development.

Research is the second part of the model. Students are taught the research process from beginning to end. Emphasis is placed on understanding research in education, locating print and electronic sources, preparing a bibliography, manual and electronic note taking, presenting and documenting research, organizing the final project, and styles of documentation. Teams work with search strategies during formal class sessions, and individual projects are assigned as out-of class assignments.

Information is part three of the model. Students are introduced to information sources ranging from traditional to non-traditional, from book to e-book, from library resource to virtual resource. All formats of material are used including artifacts, realia, proceedings, journals, magazines, newspapers, web sites, books, multimedia, video, and audio. Teams are encouraged to generate topics of interest to them as well as selecting projects for presentation that may combine any of these materials.

Technology is the one component that is apparent throughout the model. Technology productivity tools allow students to use word processing, data base and spreadsheets, graphic design, desktop publishing, video, audio and multimedia design and the creation of educational presentations. The integration of connectivity and productivity allows students to demonstrate what they have learned using performance-based criteria.

This demonstration is evident in student-managed information or educational portfolio development. Authentic assessment allows student to demonstrate desired performance through real-life situations (Meyer, 1992). The method includes projects that require students to demonstrate their problem-solving skills as well as their skills in analyzing and synthesizing information. Improved student performance is directly attributed to authentic assessment (Herman, 1992). Paulson, Paulson & Meyer (1991), define an educational portfolio as *a purposeful collection of student work that exhibits the student's efforts, progress, and achievement. The project must include student participation in selecting contents, the criteria for selection, and judging merit and evidence of student reflection.*

The types of portfolios designed by students are:

- Developmental - includes samples of student's work used by faculty to document a student's improvement over the entire semester, with self-evaluations of specific assignments;
- Proficiency - used to determine eligibility for students to advance in any assigned skill area when competence and performance are demonstrated;
- Showcase - used to document a student's best work accomplished during one semester, but can be used during an entire educational career; and
- Employment skills - includes samples of student's work over time which may be used by a prospective employer to review work readiness skills.

Requiring students to develop student portfolios provides authentic demonstration of accomplishments, and allows students to take responsibility for the work they have done. This motivates them to accomplish more in the future.

Conclusion

Teaching the use of information in a technology framework proved to be an effective strategy in the College of Education. This course *Using Information Effectively* has demonstrated that when faculty and students collaborate, positive results occur. Student projects met the needs and interests of students because they were selected by students following insightful collaboration with team members and instructors. The course design was effective because of collaboration and technology support. Students felt empowered and equipped with self management skills to go on to other courses and continue to use knowledge and critical thinking skills acquired, thus promoting lifelong learning.

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DEVELOPING A CROSS-CURRICULAR FOCUS TO INFORMATION AND COMMUNICATION TECHNOLOGY TEACHING

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Abstract: In the UK, instructional technology teachers, (more commonly known there as information and communications technology (ICT) teachers), with the support and co-operation of other curriculum specialists educate students mainly in basic ICT skills and rarely consider the application of ICT in a range of subjects. This paper describes a project to encourage ICT student teachers to work with teachers from other subject areas on a school based cross-curricular project in four local secondary schools. The outcomes of the project are discussed, including the effect on the way preservice teachers changed their perceptions of ICT across the curriculum; the teaching of ICT skills, and what changes were made the following year for the next cohort of preservice teachers.

Introduction

The role of instructional technology teachers in schools varies considerably in UK schools, and how best to prepare preservice teachers of technology in secondary schools (known as information and communication technology teachers in the UK) is a difficult issue. The way ICT is approached can be from fully integrated across the curriculum with a faculty having responsibility for the teaching of one package or application (e.g. English teaching word-processing, mathematics teaching spreadsheets, etc), to generic ICT lessons, or to ICT being team taught in personal and social education sessions. The ICT teacher in each of these scenarios alters notably, moving from a support role in the first scenario, to a full teaching role in the second and third. In addition there are numerous ICT syllabi for public examinations at age 16 and 18, which vary considerably in content from a systems approach to computing to the applications of information processing. At the Institute of Education at Warwick University we are now into the fourth year of training ICT teachers. Since last reporting (Selinger, 1998), preservice teachers' ICT teaching experience and observations are still 'often in lessons in which pupils are taught basic skills, often devoid of a context; and the process of using ICT as a tool to support and enhance all aspects of their studies and understanding is often lost' (p1280) (although there are some different and exemplary lessons emerging more and more which were disseminated to the group and identified as good practice). Ofsted, the schools' inspectorate, has also continued to report unfavourably about the content and delivery of ICT across the curriculum

> The management of information technology is weak in a substantial number of schools. In this subject, it is the curricular provision and management of resources, rather than the quality of teaching in timetabled information technology lessons, that often limit achievement and need to be monitored carefully. The co-ordination of this work across the curriculum is often poorly managed, and too few schools report progress and attainment of all pupils in Key Stage 4.
>
> Ofsted, 1999, para 127

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In University sessions the preservice teachers are involved in discussions about the importance of devising ICT lessons which will empower pupils with the tools of tomorrow, and not just teach them the rudiments of an application. As an example I discuss two scenarios for the teaching of spreadsheets. In an ICT lesson the focus would be spreadsheets using some piece of mathematics as the context in which to teach the basic functions of spreadsheets, whereas in a mathematics lesson the focus would be on a topic in mathematics, yet the same aspects of spreadsheets are being taught. There is no consensus as to which provides the most robust learning, and there appears to be little research in this area, and if my own experience is typical of others, what the learner is attending to and learning may not always be clear. However, as a tool in the mathematics lesson, the spreadsheet is being used in a meaningful way.

We discuss ways that can enable students to understand the role of ICT in all their curriculum subjects; and that help them to make informed choices about when, where and how to make use of the technology. The argument I make is that the mathematics staff and the ICT staff in a school ought to jointly plan the teaching of spreadsheets so the purpose and value of the spreadsheet is articulated from the viewpoint of a mathematician, (later the use of spreadsheets in other subjects can be discussed, and the generic functions of spreadsheets made explicit). Learning how to set up and manipulate a spreadsheet is taught in a mathematical context in which students are familiar, and the mathematics is understood, and then, when the basics have been mastered, students develop their mathematical understanding with the spreadsheet acting as a tool, perhaps learning more functions as needed on the way. The class enters into the expert mathematician's domain to observe how spreadsheets are used for doing mathematics. Spreadsheets for example have elevated trial and improvement as a mathematical process. ICT ought to be perceived as a transferable skill and taught as such.

However, it is also pointed out that there is a considerable body of research evidence which demonstrates students' difficulties in applying their learning in one context in another; this means this transferability will not happen automatically (Brown et al, 1989; Lave, 1991). Consequently we agree that ICT teachers, with the support and co-operation of other curriculum specialists, ought to be educating pupils not only in a skills base, but also teaching them to consider the application of ICT in a range of subjects, and to be aware of opportunities for appropriate uses of ICT and how ICT can enhance both the development of their curriculum subjects and their understanding of them.

Implementing the Project

In order to put this to the test, four local schools were approached whose principals had indicated their willingness to involve the 1997/98 group of Postgraduate Certificate in Education (PGCE) ICT preservice teachers beyond their statutory school experience. Previous attempts within the course to encourage ICT preservice teachers to work with peers from other subject areas had met with some limited success, so the prospect of a cross curricular project within a school context might prove even more successful. Two meetings were held with the heads, professional mentors and ICT coordinators from the four schools and a programme was negotiated.

The 27 preservice teachers were then allocated to one of the 4 schools to work in pairs in specific curriculum areas to be identified by the school. They were to spend four sessions in the school, one in the autumn term and three in the spring term and were expected to:

- research the use of ICT in their selected curriculum area
- write a joint report about the use of ICT in the that curriculum subject, (preservice teachers were also expected to find out about how their block placement school used ICT in their selected curriculum area and incorporate that in their report).

- prepare, teach and evaluate two lessons for a group of students who had particular demands, e.g. high attainers, competent ICT users, students with special educational needs. (These lessons had to be negotiated and agreed with the university tutor and the subject teacher in school to whom they had been assigned.)

Within their pairing the preservice teachers were each to teach one of the lessons and be observed by the other, who would write a critical evaluation of the lesson. The report, the lesson plans, resources developed and the evaluations were assessed formally by the University tutor as the second of three subject based assignments the preservice teachers had to complete as part of the course. In addition, a copy of the report together with lesson plans and resources were to be given to the school. The preservice teachers were expected and encouraged to use the medium of ICT innovatively in their preparation of lessons. A structure of the allocated time slots was suggested, as outlined below, but in fact many preservice teachers put in more than twice this time.

> Session 1
> Preservice teachers will be introduced to the ICT facilities in the school, and be given a copy of the schools' ICT policy to read. They will meet the head of department or a representative on the curriculum area in which they are to work who will show them any specific ICT facilities in the department, inform them of ICT policy and activities, show them schemes of work and discuss the integration of ICT. Other resources (books and worksheets, software, etc) will be made available for preservice teachers to explore. Possible ideas for projects will be discussed.
>
> Session 2
> Preservice teachers will observe a lesson being taught in the subject area by the teacher with whom they are going to work. A group of pupils will be identified and the preservice teachers will spend some time talking to them. A topic for the lessons will be negotiated with their teacher.
>
> Sessions 3 and 4
> Each preservice teacher will teach a lesson in either session 3 or 4 and be observed by the other. The subject teacher is invited to support the observation and present a report too if this is desirable and feasible, and to discuss the lesson outcomes with them.
>
> Between sessions 2 and 3
> Lesson plans and resources will be shown to and discussed with the university tutor, and then the subject teacher through electronic communications, where possible.
>
> Selinger, 1997

The schools were asked to comment on the proposal and once agreed, they would then liaise with relevant staff and inform the University tutor of the number of preservice teachers they were willing to take; the subject areas in which preservice teachers would work; and make suggestions for the best time for preservice teachers to come into school. In the event four 2-hour University sessions were allocated to the project, but as stated earlier, many preservice teachers gave far more time to the project than this. They worked in pairs.

A few preservice teachers worked in special needs departments, while the remainder worked in one of several curriculum areas across the secondary age range including science, art, English, food technology, history, mathematics, leisure and tourism GNVQ (a vocational qualification). Two groups designed a web site for the English and history departments, and one group developed a strategy for the use of a talking word processor with special educational needs students. There were several spreadsheet projects (including one that involved baking a very large cake), but the most exciting was by a student who had came onto the PGCE course with an arts background. He found himself working alone in a science department as the 28th member of the course had withdrawn. He was set the task of developing a resource for GCSE (the public examinations for 16 years olds) high attainers in a chemistry topic. He looked through the syllabus and considered ways in which ICT could be used: he settled on radioactive half-life, a topic he knew nothing about. He consulted a PhD student he knew to brief him on the fundamental concepts, and then designed a spreadsheet activity to model radioactive decay. The science teacher he worked with was ICT literate but not to the same extent as the ICT student, but they worked together on developing an interactive spreadsheet that would challenge the pupils and develop their understanding of the topic. The teacher was delighted with the final product and the pupils' enthusiasm, and it is now built into the scheme of work for the course.

Outcomes

The preservice teachers in the main found the experience extremely worthwhile and productive, and only two groups experienced any real difficulties. In a feedback session at the end of the project a number of issues emerged about working with non-ICT specialists in their own subject areas which their statutory, and more traditional school experience had not revealed to the same extent. It also raised their awareness as to what might potentially lie behind the rhetoric of schools' ICT policies in a way that would not have been so meaningful if they had been alerted to these issues in a taught University session. Below are some of the main findings:

- Only word processing was consistently used across different curriculum areas
- Pupils had poor ICT skills
- There was a lack of opportunity to use ICT rooms
- Learning both the subject and ICT often caused difficulties with students as they were unable to attend to learning new skills in both
- Teacher confidence was generally very low
- The beliefs about the value of ICT for teaching and learning varied considerably and many staff did not share the head's or ICT coordinator's vision
- There was a general lack of awareness of ICT resources for the subject
- Technical difficulties such as logging on to the network, knowledge of applications and the use of PCs at home and Acorns in schools say, often became barriers for teachers using ICT
- Access issues to suitable software, CD-ROMs and the Internet proved to be a barrier to use
- Working collaboratively with a subject specialist was a learning and rewarding experience for both the subject teacher and the ICT preservice teachers
- Subject specialists lacked new ICT skills
- Students' use of ICT applications out of the context of ICT lessons was poorer than the preservice teachers had anticipated.

The preservice teachers said this school-based experience together with the feedback session had made them much more aware of the issues of ICT use across a school. They felt that working within an ICT department alone could be misleading. The experience had highlighted the varying levels of ICT skills amongst teachers and the lack of use in other subjects. They were more prepared for their first teaching post, and agreed that it would be advantageous to make every effort to audit the use of ICT and other curriculum specialists' competence at the earliest possible stage, if their new department had not already done so.

The Following Year

Following on from this success, the schools involved were very keen to repeat the project. They saw the involvement of preservice ICT specialists as a way of encouraging staff in schools to make more use of ICT. However the schools' other development plans for ICT got in the way. Three of the schools were linking together over a high-speed network and had ambitions for the development of an innovative Intranet. Six local primary schools were also to be involved whose pupils usually progressed to one of the three secondary schools at the age of 11. The secondary principals got together and agreed that the university ICT preservice teachers could be instrumental in developing the Intranet, and provide links with the primary schools. In the event the Internet link was not working; the primary schools had not been briefed let alone involved in the secondary schools' plan for the preservice teachers; and the students became very frustrated by the lack of technical know-how of Intranet development. They spent considerable periods of time trying to establish what was required and produced some reasonable attempts at interactive web pages, which given the technical situation could not be published on the Intranet by the time they has completed their work and the PGCE course. The successes of the previous year in encouraging students to consider the issues involved in ICT development across the curriculum were not repeated. The students did learn, however, that cooperation between primary and secondary schools is a difficult process and that technical issues can prohibit curriculum development.

Lessons Learnt and What Next?

In the later project, we had focused too much on the schools' needs and not enough on the preservice teachers' needs. In the first scenario, the project has arisen out of a recognition for preservice teachers to gain a deeper understanding of how and why ICT can support learning in the curriculum, while in the second the need arose out of the schools' wishes to develop an Intranet. The first was curriculum driven, the second was technology led. Another lesson learnt was that preservice teachers need to be involved in developing projects from an existing situation rather than being led into the unknown. They are inexperienced and eager to please, and can be in danger of being exploited in novel situations. Preservice teachers' needs have to be recognised, and schools need to offer support rather than expect the inexperienced preservice teachers to provide training.

Negotiations with the schools had been excellent at top level, but finding willing teachers in the secondary schools to become involved is not always easy given the constraints on teachers' time and the pressure of the curriculum. However, such was the success and mutual benefits, it was agreed to run the project again and this time the 1999/2000 preservice teachers are working on cross phase projects within three secondary schools. Success is likely as the UK Government has made ICT a priority with a budget of over £600 million being made available to schools to update computers; introduce or improve existing networks, connect schools to the Internet, and train teachers in the use of ICT, (DfEE, 1997), and schools are keen to be seen to be in the forefront of development.

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Pairing Up Inservice and Preservice Teachers to Develop an Understanding of Technology Integration

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Abstract: This paper will describe a course taught at the University of Alberta that focuses on technology integration across the curriculum. In this course preservice and inservice teachers are combined into the same class. The experience has been mutually beneficial for the two groups and resulted in interesting classroom dynamics. The goal of the course is to help students develop a better understanding of critical thinking and the role of technology in the classroom. The strategies and assignments used in class are also described in the paper.

Introduction

The purpose of this paper is to describe a course taught at the University of Alberta that focuses on technology integration across the curriculum. The goal of the course is to help students develop a better understanding of critical thinking and the role of technology in the classroom. Naturally then the major assignment for the course requires students develop a project to promote critical thinking while taking advantage of computer technology's unique attributes. The learning strategies used in the course are based on Brown, Collins, and Duguid's (1989) notion of situated cognition and Collins, Brown, and Newman's (1989) notion of learning through cognitive apprenticeship. These authors suggest that concepts need to be contextualized and developed progressively through activities. Cognitive apprenticeship requires making the concept of technology integration explicit through readings and class discussions. This is complimented with lab assignments that focus on developing examples of technology integration with specific applications. These steps prepare the student for the final project by scaffolding onto prior activities. The final project should be built with actual integration in mind. That is students should be in a position to implement their project. It is my belief that these students will then be able to independently create further projects for their classroom.

Before describing the course any further it is important to define technology integration as presented in this course. Taylor (1980) described three roles for computer technology in the school. One, is as the object of instruction, that is students would be learning about computer hardware, software, programming etc. Computer technology's second role is to deliver instruction. In this role Taylor was referring to computer assisted instruction, which today has evolved into web-based instruction and the notion that learning can take place "anywhere, anytime." The third role described by Taylor looks at using computer technology as a tool for information processing and communication tasks. In the course described here technology integration is based on the perspective of this third role. This role has evolved throughout the years and now computer technology is not just seen as a productivity tool but rather as a tool for thinking or as Jonassen (1996) refers to it as a "mindtool". Although the two other roles for computer technology have merit it is this mindtool role that appears to have the most potential for cognitive development (Jonassen, 1996, Logan, 1995, President's Committee of Advisors on Science and Technology, 1997, Reginald Gregoire inc., Bracewell & Laferriere, 1996). This view of technology integration is also supported by the Alberta Government through its prescription of a new curriculum that requires technology outcomes be integrated into core subjects such as Mathematics, Social Studies, Language Arts, and Science (see http://ednet.edc.gov.ab.ca/techoutcomes/). This curriculum looks at using computer tools for problem solving, inquiring, decision making, and communicating.

Looking at technology integration in this way requires that constructivist approaches to teaching and learning be adopted. In many ways the course is more about constructivist pedagogy than it is about technology.

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The potential for computer technology to act as a tool for thinking can only be realized within a constructivist activity. The constructivist approach is difficult for some students to grasp because of firmly entrenched traditional beliefs about teaching and learning. Keith Yocam was involved in staff development in the Apple Classrooms of Tomorrow (ACOT) project and observed that " It seems far easier to help a teacher who is already practicing constructivist methods learn to use technology to enhance student learning than it is to help a teacher who has a lot of knowledge about technology but limited knowledge of constructivist pedagogy" (Yocam, 1996, p.268). I try to model constructivist approaches in as many ways as possible in the hopes that class participants will recognize the impact such strategies have had on their own learning and thus consider similar strategies in their teaching. Below is a description of some the activities and assignments used in class.

Course Description

EDSE 478/578 is an undergraduate/graduate course designed to help educators understand the role technology can play in the classroom and to develop some of the skills needed to integrate technology into classroom activities for their students. Initially combining undergraduates and graduate students was done to meet minimum enrollment criteria but it soon became evident that this was an advantageous situation. The graduate students are for the most part teachers enrolled in a part-time M.Ed. program. The undergraduates are students who have completed student teaching and are in the final stages of their program. The graduate students have additional readings and expectations, in terms of scholarly work, are higher. Combining preservice and inservice teachers in the same class has been mutually beneficial for the two groups and resulted in interesting classroom dynamics. It is in fact rare to have preservice and inservice teachers engage in lengthy discussions about teaching and learning. Each group is enriched by the other. The inservice teachers bring wisdom gained through experience and the preservice teachers bring contagious enthusiasm. Revisiting critical thinking, identifying purposeful learning activities, and working with beginning teachers has been a rejuvenating experience for the graduate students.

Students are given a number of articles to read and these are mostly discussed online but the final debriefing on the articles is held in face-to-face discussion. The online discussion of articles gives students more time to reflect on the responses and more time to formulate their own contribution to the discussion. The asynchronous communication component of the course is intended to promote reflective practice. For example, the students are given a number of readings that describe critical thinking and these are discussed online. Various points of view emerge and these are further discussed in small face-to-face groups. The various views are discussed in small groups. Students then develop a working definition of critical thinking and are asked to identify its key attributes. That is, what elements make a learning activity one that will foster critical thinking? Critical thinking is a concept that is widely used in education and yet poorly understood. In this part of the class it is important that students develop an understanding of critical thinking. They need to determine what it is and what it isn't by examining examples of lesson activities and identifying the thought processes and skills a student would need to undergo to achieve the task defined in the activity.

Using a similar technique students are asked to identify the unique attributes of computer technology. That is, what features allow us to do things we could not do before or wouldn't do because the task was too labor-intensive? Students are asked to brainstorm these attributes. It should be mentioned at this point that the prerequisites for this course require students know how to use the Internet, spreadsheets, and databases. Even though students have the prerequisite skills some cannot be considered confident computer users. When asked about the unique attributes of the computer they usually refer to automation of labor-intensive tasks. In many ways they continue to use the technology to perform old tasks faster. For example, they continue to use a word processor as a typewriter and a spreadsheet as a calculator. After much discussion students realize that computer technology lets us communicate with experts or individuals who can offer and entirely different perspective on an issue. The use of the Internet now exposes students to authentic problems and research. Computer technology helps us to manipulate data and reorganize it in a way that makes patterns or relationships evident. It also allows us to visualize data in a way that could not be done before.

Once students have looked at critical thinking and the attributes of technology they are asked to create short lesson activities that require the use of spreadsheets and databases. These activities have to be designed to promote critical thinking and take advantage of the unique attributes of technology. For example, one activity might have students extract authentic data from the STATSCAN site (http://www.statcan.ca/english/Estat/estat.htm) to examine smoking habits of 15 year olds across the world. Students would have to generate their questions about smoking habits and then query the database for an answer. Ideally one question would lead to another.

Guided discussion of critical thinking and technology integration is used to provoke undergraduate and graduate students into examining their own beliefs about teaching and learning. This examination of beliefs is often difficult for undergraduate students as they make the transition from student to teacher. Many undergraduate students are in the initial stages of forming a teacher identity and coming to grips with their role in the classroom. As a result it is difficult for them to develop meaningful activities instead of "busy" activities. Often these students do not have a clear sense of purpose for the activities they develop. They also lack knowledge of the curriculum. Undergraduate students have small pieces of the picture but at this stage of their career they lack the vision an experienced teacher would have of curriculum. In our face-to-face and online discussions the undergraduate students have many opportunities to ask questions and to develop a better understanding of teaching and learning. In addition, these students listen to the discussion (sometimes heated discussion) amongst the experienced teachers. Not all the teachers in the course are open to trying constructivist strategies in their own classes. This usually generates quite a bit of controversy as other teachers challenge the nonconstructivist teachers' beliefs about teaching and learning.

Regardless of teaching experience both groups struggle with the concept of technology integration. To assist in this concept attainment the students are presented with videotape segments of learning activities that incorporate technology. The videotapes used were purchased from the North Central Regional Technology in Education Consortium (NCRTEC) which is a subgroup of the North Central Regional Educational Laboratory (NCREL) (see NCRTEC's website http://www.ncrtec.org/). The examples are discussed and evaluated in terms of their ability to promote critical thinking and to take advantage of computer technology's unique attributes. This examination of example/nonexample technology activities prepares students for their major assignment.

Keeping with a constructivist perspective the major assignment for this course is meaningful and relevant for the student. The graduate students (inservice teachers) develop a project that can and should be implemented in their own class. For the undergraduate student this task lacks relevance and is difficult because of their lack of familiarity with the curriculum. Therefore these undergraduate students are paired up with teachers in the field who have been interested in technology integration but have not had the time to develop curriculum in this area. The cooperating teachers are carefully selected with the assistance of personnel in the surrounding school districts. It is imperative that these undergraduate students are placed with teachers that support constructivist pedagogy. The undergraduate student meets with the teacher to get background information needed for the project. In this discussion the undergraduate student can describe some of the activities presented in the course. Together the teacher and undergraduate student generate an idea for a technology integration activity that focuses on a specific curricular area. The undergraduate student is responsible for developing the project so that it will work with the technology and resources available in the school. This assignment presents undergraduates with an authentic task and they become accountable to someone else other than their instructor for the course. The teacher and undergraduate student meet face-to-face and online to discuss the project. Draft versions of the project are submitted to the teacher for feedback. The cooperating teachers view the relationship as mutually beneficial and in the end they have a product that can be used in the classroom. Some projects are better than others but nonetheless the result is a valuable learning experience for all those involved.

Conclusion

The course has varying amounts of success. Much of this seems to hinge upon the participant's beliefs about teaching and learning. Students that believe in constructivist approaches tend to enjoy the course and believe the class assignments are practical. Students that do not believe in constructivist approaches feel the course is far too theoretical and the assignments could never be implemented in their own class situation. There seems to be much more resistance from the high school teachers. Some of the hesitation stems from the infrastructure in place at a high school. Teachers are given 60-80 minute blocks of time to cover their subject making it difficult to pursue project-based activities. In addition, teachers of a particular subject area tend to have their own staff rooms thus little dialog is promoted between the teachers of different subject areas. This kind of dialog is necessary for the creation of interdisciplinary projects focusing on authentic tasks. But even without these obstacles there still are teachers who do not believe constructivist strategies could be used effectively to cover all the content that needs to be covered in a high school curriculum. If participants of the course strongly hold such beliefs there can be quite a bit of tension in the class atmosphere. Sometimes that tension intimidates the undergraduates and can defeat the purpose of combining graduate and undergraduate students into one course. At the same time though this tension stimulates deeper introspection, students are challenged and they need to explain their beliefs not just assert them.

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INFUSING TECHNOLOGY INTO THE PRE-SERVICE CURRICULUM: HOW ARE WE DOING?

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Abstract: This paper reports on a project designed to change the way pre-service teachers use technology. A consortium of university and public school faculty are collaborating to improve pre-service technology integration skills by modeling those skills in their classrooms and in the field and requiring technology components for student field activities. A thorough needs assessment of the population was followed up with a plan to increase instructional effectiveness of faculty and Demonstration Teachers modeling for pre-service teachers.

Introduction – The Need for Change

Pre-service teachers will be the teachers of the 21st century. As such, they must develop the necessary technology knowledge and skills to prepare the next generation of students. If they do not, they will perpetuate the lack of technology expertise that is the national norm of the current generation of teachers (Moursund & Bielefeldt, 1999). Not acquiring these skills during their pre-service program will cost school districts greater hardships because they will ultimately have to bear the financial responsibility for expensive staff development. Pre-service and in-service education systems have struggled to keep up with the rapidly changing pace of technology development (Moursund & Bielefeldt, 1999). Since the publication of *A Nation at Risk*, student to computer ratios have improved from 125:1 in 1983 to 13:1 in 1998. Becker, et al. (1998), however, estimate that the total number of computers in private and public schools is slightly more than one per five students – a 15-fold increase in 15 years. Internet access has now been provided to eighty-five percent of schools and forty-four percent of classrooms (Jerald, 1998). These tools are influencing the way we think about, access, and use information. In an effort to prepare students for the information age, public schools are increasing access to these tools by putting more hardware and software in schools; connecting schools to the internet; and providing cable and satellite capabilities (Zehr, 1997; Zehr, 1998).

Having access to technology tools is only part of the answer. Teachers must become more knowledgeable about technology and be able to integrate these tools into their teaching and student learning projects. School districts throughout the country are making efforts to increase the use of technology through staff development activities and providing on-going technology support. However, this training must begin with pre-service teacher education (Wetzel, Zambo, Buss, & Arbaugh, 1996).

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In a 1998 national survey, the International Society for Technology in Education (ISTE) surveyed schools, colleges, and departments of education (SCDEs) in the United States about how they were preparing new teachers to use information technology (IT) in their work. Among other findings, the institutions reported that most of their faculty do not model use of those IT skills in teaching, so therefore, most student teachers do not routinely use that technology during their field experiences and do not work under master teachers / supervisors who can advise them on IT use.

In 1998, a SouthEast and Islands Regional Technology Consortium (SEIR*TEC) survey concluded that that students do not know how to integrate various technologies into their teaching. The Georgia Department of Education (1998) published a technology needs assessment, which found that there is a large gap between the plans for needs and the actual uses of technology and the capacity of the present technology resources and infrastructure to meet those goals.

Carlson and Gooden (1999) surveyed 92% of the Georgia Southern College of Education students who had completed their student teaching experience over a one-year period to investigate how student teachers assimilated and applied technology. This study found that students felt comfortable using word processing and, to a lesser extent, email and the WWW - the only technologies they saw modeled by their professors.

All of these studies, national, state, and local, come to the same conclusions concerning the use of technology in teacher education. Overall these studies recommend that:

1. Technology should be integrated into all courses that pre-service teachers take.
2. Institutions of higher learning should identify examples of technology integration for all courses that pre-service teacher take.
3. College faculty, that teach pre-service teachers, should model effective uses of technology in their classroom.
4. Pre-service teachers need more opportunities to apply Instructional Technology during their field experiences under qualified classroom supervision.

Additionally, the Board of Regents for the University System of Georgia recently mandated curriculum changes in all pre-service education programs. Key elements of these changes include: 1) strengthen the content background of the pre-service teacher to meet rigorous academic standards; and, 2) assure that future teachers are technology-proficient and understand how to infuse technology into the curriculum to improve learning and achievement.

The Project

In order to address these mandated changes and to build an active learning community that bridges the gap between post-secondary institutions and K-12 schools in Southeast Georgia, a consortium was created. The consortium members include an institution of higher education, Georgia Southern University (GSU), GSU's College of Education (COE) and five local public school districts (LEAs). The public school districts include 27 elementary schools, 10 middle schools and 10 high schools.

This consortium was carefully crafted based on the memberships' history of cross-disciplinary collaboration and their potential contribution to innovative teacher preparation program reform that will enable future teachers to infuse technology into the classroom. Each member has unique resources available to support a shared vision of an innovative teacher preparation program and willingness to contribute to the comprehensive effort of improving teaching and learning with new technologies.

This consortium forms a new community of learners that provides sustained support for both the experienced and novice teacher. Further, it helps bridge the gap between college teachers, pre-service teachers, and K-12 classroom teachers by providing continuous professional development. This also paves the way for future teachers who might enter the profession through alternative certification by supporting them as they build the experience they need to become technology-proficient teachers.

This project was designed to document and identify specific gaps and weaknesses in the delivery of instruction to pre-service teachers and to support comprehensive teacher preparation program improvements that infuse technology throughout the teaching and learning experience of all future teachers. The goal of the project is to develop technology-proficient future educators by providing professional development for college faculty and public school demonstration teachers through the integration of technology into the curriculum. This goal is a part of a comprehensive restructuring of GSU's teacher preparation program designed to improve teaching and learning with rigorous academic standards for all students. This goal will be met through an extensive needs assessment; the identification and development of "Best Practices"; extensive training of college faculty, student teacher supervisors and demonstration teachers; and, revision pre-service education curriculum and field experiences. Specifically, this project addresses the following objectives:

1. **Assess needs and opportunities for technology program improvements in the pre-service teacher curriculum and course content.**
2. Identify and develop a core of strategies and techniques ("best practices") for dissemination to faculty, demonstration teachers and pre-service teachers.
3. Train College of Education methods and practicum faculty to integrate technology into their lessons and to model the effective use of technology.

Project Activities

The project is being implemented in three phases: I) assess needs and identify opportunities for infusing technology into the teacher preparation program, II) develop innovative strategies and techniques to respond to these needs, and III) provide faculty with professional development to integrate new technologies into their courses and model technology-proficient instruction. Within these three phases, the project will be divided into specific tasks.

Task 1.

An extensive needs assessment began in Task 1. Previous to this project, Carlson and Gooden (1999) had assessed the state of technology integration in the College of Education among the pre-service teachers and the faculty. Major findings were that the only technology that was available and used across the board was word processing. Internet technologies had some medium measure of use. The opportunities for this group clearly rests in extending the types of technology used in instruction and application.

To address the other groups working closely with pre-service teachers, both consortium and non-consortium Demonstration Teachers, highly qualified, specially designated public school faculty, were surveyed to establish their technology strengths and areas for possible improvement. One hundred seventeen (117) out of 262 surveys were returned for a 45% return rate. Ninety percent (90%) of the surveys were from females. Consortium teachers comprised 77% of the returned surveys, both consistent with their proportions among all Demonstration Teachers. Fourty-five percent (45%) taught elementary children, 24% middle school, and 31% high school. Experience at each level was between 11 and 12 years teaching. Seventy percent (70%) held a Masters degree or higher. We were interested in the technology training and support for these teachers. Approximately half (46.2%) had completed Georgia's InTech, advanced state sponsored technology training. InTech was also the most recent technology training for the Demonstration teachers (41%), with school-based training (24%) and the Georgia state sponsored Regional Education Services Agency (RESA) training (21%) well behind. Only 3% listed college/university courses as their most recent technology training. In-school technology support was most often provided by the media specialist (37%), with county specialists (19%), in-school technologists (15%), and RESA specialists at 14%.

	0%	20%	40%	60%	80%	100%
High School	74.3	22.9	1.4	1.4		
Teacher Preparation Course	54.3	35.7	8.6	1.4		

Graduate Education	50.8	44.6	1.5	3.1		
Staff Development/ In-service	7.7	32.7	19.2	16.3	18.3	4.8
Self	1.0	29.1	17.5	16.5	30.1	5.8

Table 1: Technology skills acquisition for Demonstration Teachers.

Table 1 shows Demonstration Teachers' responses when asked where they acquired their technology skills. Both teacher preparation and graduate education played relatively minor roles in their skills acquisition. Clearly, this needs to be improved.

	Not Available	Available in Building	Available in Classroom	Available in Home
Word Processing	0.0	42.3	89.7	89.7
Database	1.8	44.9	77.9	78
Spreadsheet	0.9	41.3	83.5	80.5
Desktop Publishing	7.7	45.3	62.5	75.0
Electronic Presentations	6.9	66.7	39.3	31.4
WWW	0.9	48.2	63.7	76.7
Email	0.9	44.3	61.1	73.3
Scanner	16.3	64.4	12.6	28.0
Digital Camera	17.9	70.8	10.4	8.5
Galileo	21.6	59.1	32.9	29.5
Videodisc	44.0	47.6	10.6	3.6
Satellite TV	19.8	59.5	27.8	18.0
GSAMS	50.0	49.9	1.4	1.4
Scientific probes	87.7	9.2	3.1	0.0
Graphing Calculator	53.7	30.6	10.9	15.9
Electronic Notepad	78.9	12.7	5.6	9.8

Table 2: Availability of Technology for Demonstration Teachers.

Table 2 shows that technology, with the exception of highly specialized technology, is available to most teachers somewhere. The lottery money spent on technology has filtered down to the schools in rural southeast Georgia. However, more can be done to improve access to technology, especially in the classroom. Notable was teachers' access to office productivity tools and to the internet at home.

	Average	Standard Deviation
Word Processing	3.7	0.5
Database	2.6	0.9
Spreadsheet	2.6	0.9
Desktop Publishing	2.8	1.1
Electronic Presentations	2.3	1.1
WWW	3.2	0.9
Email	3.3	0.8
Scanner	2.1	1.1
Digital Camera	2.1	1.1
Galileo	2.1	1.2
Videodisc	1.7	1.0
Satellite TV	2.0	1.6
GSAMS	1.4	0.7
Scientific probes	1.1	0.5
Graphing Calculator	1.5	0.9
Electronic Notepad	1.2	0.7

Table 3: Demonstration Teachers' Self-reported Technology Proficiency

Demonstration teachers' technology proficiencies (Table 3) were similar to the proficiencies previously reported in other studies and similar to those reported by pre-service teachers. The only technology that the teachers showed confidence with was word processing, followed by internet-based technologies.

From these needs assessments, we determined that access to technology was adequate and improving, but can be further improved with additional allocation of resources. This observation is offered because access is a prerequisite to infusion, however this project did not propose to address problems of this nature. Teachers still do not have the proficiency in technology use required to integrate the technology into their lessons. Therefore the need is to train the teachers both in use and integration skills simultaneously.

Task 2

The Project Team has set up a Web site to provide information to all project participants. Currently the Web site provides
1. an overview of the COE Technology Infusion Project,
2. local resources (hardware and software) that are available to faculty and students, and
3. links to Web sites that provided resources for integrating technology into the instructional process.

Web sites of additional instructional resources will be added to the list when suggested by participants.

The Project Team has consulted with educators in the consortium (e.g. public school curriculum directors, principals, media specialists, COE faculty, and Demonstration Teachers) in order to start to identifying teachers who are currently infusing technology into their daily lessons. During the Spring semester, appropriate Project Team members will visit the technology-proficient teachers to discuss and observe their practices in their area of expertise

The Project Team set up a series of faculty workshops that were delivered during the Fall Semester. The topic for each of the workshops was developed by input from faculty. The workshops delivered so far are:

1. *Available Resources*. This workshop provided the faculty with the resources (both hardware and software) that are available to them, their students, and the College's Demonstration teachers. Several Web-based Resources were also discussed.
2. *Search Techniques*. This workshop provided faculty with information on how they could effectively search the Web. A comparison of Search Engines was discussed with an emphasis on those that are the most effective in an Educational setting. Boolean logic and how it applies to searching was also discussed.
3. *GA InTech Program*. The Director of the Teacher Training Center, located in SE Georgia, provided an overview of the GA InTech Program. InTech, GA Framework for Integrating Technology, is designed to support the existing P-16 curriculum using technology as a catalyst for changes in the teaching and learning process. All Georgia teachers are expected to have received InTech training by June 2001.
4. *Integrating the Web into the Instructional Process*. This workshop provided the faculty with information on how the WWW could be integrated into the instructional process. Included in the discussion was information on how Web Sites could be downloaded for use in classroom without direct internet connections.

This series of workshops will continue during the Spring semester and will include topics as identified by the faculty and the evaluation process. Public School teachers who are currently infusing technology into their classes and have been identified, by their county school district, as exemplary teachers will also be brought to campus to share their experiences with both faculty and pre-service teachers.

Task 3

As a follow-up to each workshop, Project Team members will identify technologies that will enhance individual courses. This will include specific classroom activities and techniques for modeling the use of various technologies. We are currently developing a database of instructional lessons, that make use of technology, that are being delivered in the school districts that are part of the consortium. This database will allow COE faculty who are in charge of practicum students, to make observation assignments for their students. Future plans include having this database available on the project web site so that it can be searched by all project participants.

Evaluation is an integral component of the overall program. It is both formative and summative by design. Information from the evaluation will provide performance feedback that will help guide the development of strategies for full-scale implementation of teacher preparation program improvements and assure that the program goals and objectives are met. Both qualitative and quantitative data will be collected on a periodic basis to inform all stakeholders of progress toward achieving the intended outcomes as well as establish clear benchmarks for documenting future improvements.

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Preparing Teachers for the Digital Age: Implementing a Dynamic Model of Pedagogical Change

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Abstract: This paper presents the concept and beginning work of one of the Preparing Tomorrow's Teachers to use Technology research grants. The Department of Education initiative is to infuse technology into the teacher education programs to prepare more technologically proficient teachers for future classrooms. The model created by a consortium of 3 public universities in rural Western Pennsylvania looks to infuse technology into the pre-service teachers core curriculum and several teacher education programs. Some 1,500 future teachers per year placed throughout the U.S. and seven foreign countries will be affected by this change. Four goals will be accomplished: 1) Instructional Technology will be moved from the periphery to the core of our curriculum. 2) Future teachers will apply and integrate Instructional Technology into the teaching/learning process. 3) Additional Faculty, instructional designers, and technical support staff will assist with the transition. 4) The consortium will provide the infrastructure support needed for teacher preparation in the digital age. Evaluation strategies will include baseline and follow-up surveys, student portfolios, interviews, and focus groups.

Introduction and Problem

The Commonwealth of Pennsylvania certifies approximately 13,000 teachers yearly and each one must be prepared to teach in the 21st century. These students must master the skills required by a digital age (problem solving, inquiry, and reflection) and have the ability to function in a workforce dependent upon access, utilization and application of information technologies. Today, at the turn of the century, there are already teaching position announcements posted only on the Internet--it is clear that computer illiterates need not apply.

Teachers teach the way they were taught, but unfortunately, they have not been taught in a manner that demonstrates technology infusion. Instead, they have traditionally been taught Instructional Technology in a separate, "isolated" course in the education curriculum. These students will face an uphill battle to integrate instructional technology effectively in content areas because they never see it modeled in their core and content courses in college.

There are many reasons why some college faculties have been slow to integrate technology into their teaching. Certainly, one significant reason is that technology in the classroom changes social relationships.

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Some faculty that are exhilarated by the change brought about from integrating technology in their teaching, while others are concerned about how technology impacts their authority, control of students, and knowledge of the teacher's role (Cuban, 1999). Other reasons include: an academic tradition that values deliberation and incrementalism, lack of suitable training, lack of technical and administrative support, lack of systemic incentives (tenure and promotion), traditional pedagogical beliefs, and the lack of hard evidence that technology can serve their needs and make their work move effective and interesting (Albaugh, 1997, Freberg, 1995, Olcott, 1999, Oppenheimer, 1997, OTA, 1995, Spotts, 1999). It is clear that getting faculty to use technology remains a challenge (Olsen, 1999).

To promote the effective use of technology in teaching and learning, we need a new approach. Hence, President Clinton's Educational Technology Initiative appropriately made training and support for teachers to help students learn through computers and the information highway one of the four pillars of his program. The teacher workforce will experience a rapid turnover in the next decade. The need to fill a demand for 2.2 million new teachers is fast approaching, and the question needs to be asked: "Will they be ready for the digital age?"

Project Design

Clarion, Edinboro and Indiana Universities of Pennsylvania are committed to training teachers for the new millenium. These universities have worked together since 1998 as partners in the ADEPTT Consortium (Advancing the Development of Educators in Pennsylvania Through Technology Training). The ADEPTT consortium was funded by the Bell Atlantic and Microsoft corporations to provide foundation training in instructional technology for faculty and K-12 teachers. The consortium is now attempting to go one step further by infusing technology into the pre-service training of all their teacher education students. All three universities agreed on the following goals to be accomplished over a three-year period:

Goal 1: To infuse instructional technology more deeply into the teacher curriculum in both education core courses and selected majors.

The foundation of this goal is eleven key competencies that reflect the recommendations of NCATE and the Pennsylvania Department of Education. The competencies include the following:

- operating systems management
- word processing
- spreadsheets
- web browsers
- email
- presentation software
- databases
- multimedia packages
- video conferencing
- moderating chat rooms
- Internet in teaching

To achieve this goal, we will pursue four objectives, each one building on the preceding as it moves us to a teacher preparation program that has technology infused throughout the curriculum.

First, the grant will train faculty to effectively and appropriately use and teach the eleven key competency skills. This is the starting point of our effort and builds upon the foundation training for faculty provided by the existing consortium of the three universities known as ADEPTT.

Second, we will work to have university faculties model how to teach effectively with technology in education core courses and subject area courses. This objective is critical to change the teaching paradigm so future teachers will learn in a technology-enhanced manner and will be better prepared to teach in this way.

Third, the faculty will be encouraged and supported to create assignments within education core and subject area courses based upon the appropriate use of the eleven competencies. Through its active learning approach, this objective reinforces the acquisition of needed skills by the pre-service teachers. It also provides clear examples for pre-service teachers to use in their teaching careers.

Finally, the end result will be revisions of course syllabi to reflect and recognize the integration of technology into the curriculum. Wherever feasible, such courses will be designated as /T/ courses to identify their technology emphasis.

Goal 2: Integrate instructional technology in the consortium's pre-service observation and field experiences. These experiences provide a gradual process of immersion in which the pre-service teacher sees and "experiences" the K-12 teaching environment. During these exercises, we will take steps to assure that students receive a triple exposure to instructional technology—(1) seeing how it is used in the classroom; (2) using videoconferencing technology to enrich observations and field experiences, and (3) incorporating technology through moderated chat rooms and threaded discussions to help students share their experiences and insights.

In 1997, IUP received the United States Distance Learning Association award for the best distance learning program in the nation. Funded by a FIPSE grant, this program used two-way interactive compressed videoconferencing. Pre-student teachers at IUP were able to unobtrusively observe classes in progress in K-12 schools. Faculty helped explain what was occurring and pointed out tips and strategies. Following the observations, students were able to talk with the K-12 teachers over the video link to discuss what they had seen and to ask why a teacher used particular techniques and methods. Now that the FIPSE grant has concluded, we have ideas, lessons, methods, and the experience to achieve this second goal.

Goal 3: Provide a variety of professional support of opportunities for faculty and pre-service teachers. A critical factor in introducing technology into any environment is the support of peers and technology professionals. Support will come from "teaching circles" which will provide an opportunity to establish and sustain instructional technology networking and peer mentoring opportunities. There will also be consulting faculty who will be able to provide training and one-on-one assistance to their peers applying instructional technology to teaching and pre-service teachers learning to integrate technology into their beginning lessons. The universities are also working to strengthen their help desk services for faculty and students and to expand basic foundation training through the ADEPTT consortium and instructional programs. For example, IUP's "incubator" computer laboratory in the College of Education provides valuable professional and technical support and is a program that will grow to help support these efforts.

Goal 4: Enhance the technological infrastructure of the consortium members to better support project initiatives. A lack of sufficient infrastructure is a major impediment to the infusion of technology into the teacher preparation curriculum. Computer labs will be upgraded so that advanced computing skills can be developed among the graduates of the three universities. The enhanced technology infrastructure will allow students to work in a networked environment with student network spaces, as well as network space for courses to work through. Increasingly, school districts are looking for employees who are familiar with a networked environment. The three universities are committed to ensuring their faculty have adequate multimedia computers to facilitate integration of technology into their courses. Faculty are also actively involved in technology planning. The three universities each have variations of the American Association of Higher Education's Teaching and Learning Technology Roundtables to encourage faculty input on campus technology development.

The Evaluation Component

Baseline data will be collected on the current use and implementation of technology in the teacher preparation curriculum of the three universities. This will be done by surveys with pre-service students, faculty and recently graduated in-service teachers. There will also be an analysis of syllabi. Building on existing Instructional Technology foundation training, we will offer new workshops on Instructional Technology application and integration. The latter workshops will primarily be in the second year of the project. One-on-one consultations and training will also be provided, and evaluations will be conducted of both group workshops and individual consultation after each session. There will be curriculum revisions, courses enhanced with instructional technology, by the third year.

The data from years one and two will be compared to collected syllabi, surveys and portfolios of year three of the project.

Conclusion

The positive aspects of the model are recognized throughout Pennsylvania and on the national level. Pennsylvania Governor Thomas Ridge has made technology and its use a major initiative in K-12 education. Ridge's three-year, $132 million Link-to-Learn initiative is aimed at expanding the use of technology in the classroom, including new and upgraded computers for schools and technology training for teachers. Nationally, the Clinton-Gore administration has pushed for connectivity to the World Wide Web for every American. Indeed, their administration has the goal of making computers, computer related multimedia, and the World Wide Web standard tools for teaching and learning.

The successful implementation of this model will demonstrate that technology can be infused into all areas of the teacher preparation program. The three schools involved graduate 1500 teachers per year. With this model each graduate will be able to utilize technology in their teaching and be leaders for change in the wired and connected school districts which hire them to teach.

The problems associated with this project are of national concern and seem to be increasing in scope. Consequently, this three-phase project will add important information to the literature of technology and its integration into the teacher preparation curriculum. If the model is successful, it has the potential to be replicated at other teacher preparation programs, particularly since it will already have been tested at three institutions with different programs. Thus, other institutions will be moved toward integrating the use of technology into their teacher preparation programs.

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Increasing Instructional Technology Competencies for Faculty and Students in an Education Preservice Program

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Abstract: Education Faculties around the world continue to struggle to develop instructional technology strategies to build and promote their respective undergraduate Teacher Education programs. Successful implementation of instructional technology (IT) is perceived as to allow our revised programs to produce teachers well able to bring success into our 21st century schools. In order for pre-service teachers to integrate technology as a deep and meaningful element of new instructional practices, teacher education faculty need to both model and support technology as an integral part of their instruction. As the pace of technology accelerates further in and with education, our Faculty's Instructional Technology Committee continues to develop and refine its 'Vision' of how the technology of today can seamlessly be integrated into the instruction of the future. Constructed and represented here are specific goals on how our faculty hopes to approach the overwhelming need for instructional technology competencies in our emerging educators. Our Faculty of Education continues its worthwhile struggle to integrate technology into all levels of instruction, into all of its Teacher Education Programs, and in sharing this struggle, we hope to give insight to others in similar circumstances.

Setting the Context

Saskatchewan's unique demographics, rural economics, and progressive nature, have prompted essential change in the provincial Education system recently. With an inadequate number of graduating teachers each year emerging from either of the province's universities, a growing number of students in remote rural locations, and a lack of instructional resources and educational dollars in our already crowded urban schools, Saskatchewan Education continually struggles to look for viable options toward more efficient instructional methodologies. As we battle to maintain the integrity of our educational programs, recent reactionary developments have risen from our province's necessity to compete in a widening global arena.

It is becoming Saskatchewan Education's mandate to provide the province's school-aged students with a diversity of educational opportunities effectively leading to their future success in the Information Age. Evidence of this directive is apparent in Saskatchewan Education's development and creation of the Evergreen Curriculum (http://www.sasked.gov.sk.ca/docs/evergrn.html), a dynamic web site hosting the province's entire K-12 curriculum and approved educational resources. With the development of the Evergreen Curriculum, all residents of Saskatchewan, Canada, and the world, can view the on-line curriculum documents, analyze lesson plans and resources, and dynamically assess our province's educational 'product'. Further evidence of Saskatchewan's mandate manifests itself in the province's commitment to Distance Education. Distance Education programs continue to develop in rural and urban settings, and Saskatchewan Education continues to pursue partnerships with its educators, universities, multimedia design companies, and local Tel-Co providers. With both the on-line accessibility of our curriculum resources, and the commitment to further Distance Education programs, we can begin to extrapolate what this will mean for the future of our traditional schools.

It is increasingly clear that the teacher of tomorrow can no longer rely on outdated methodologies to effectively teach the 21st century student. William Clark (1994) states in his article referring to the "high-tech classroom of the future" that the evolution of the classroom "will be characterized by the steady replacement of traditional basal programs by multiple media programs and collections of supplemental

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materials. Some of these materials will be classroom resident. Others will flow through various manifestations of the information highway" (Clark, 1994, p. 62). The roles of teachers are changing, as are society's expectations upon them. Teachers are now expected to incorporate instructional technology into living practice with IT skills leading the way to success for their students. As requests for educational reform increase, comprehensive changes in traditional teacher roles seem an inevitable part of the total restructuring package.

Distance Education, multimedia, web-based learning, instructional technology; these are terms commonly heard by the average teacher, but rarely completely understood. Not only are the technologies themselves misunderstood but more significantly, their underlying pedagogical implications are scarcely realized. Marita Moll, a strong critic of information technology, states "I believe that information technology can be extremely empowering, extremely motivating and extremely conducive to creating new and exciting classroom environments. However, we need to develop a better understanding of how new technologies will effect our learning environment -- both positively and negatively" (Moll, 1997). This criticism comes as tremendous amounts of dollars continue to be allocated towards technology upgrades for schools. However, at the same time there are lesser dollar amounts contributed towards teacher training in learning theories, research of instructional technologies, or investigations into technology learning outcomes. Ironically, due to the unprecedented speed of technological change, administrations can only reasonably push for the technologically 'average' school. However, in the same push, teachers are left merely adequate in their instructional skills and understanding. Still, the wheels of change roll relentlessly.

As the educational infrastructure continues to evolve in Saskatchewan and the world, Teacher Education Programs are under tremendous pressure to continually improve their 'product'. Our faculty must continually analyze the successes and failures brought by these times of technology-induced growing pains. Our vision remains strongly founded upon technological and pedagogical diversity. However, vision alone is not nearly enough for change to occur. Collectively, faculty must address the shortfall of technological competencies in both graduating students and faculty members. It is with the cold realization of these deficiencies, that planning may commence toward necessary mechanisms of change. Luckily, and I strongly believe that, "we are fortunate to work in a faculty where collaboration and change are the
Maeers, Browne, Cooper, 1999)

The above mentioned paper, written by professors from our Faculty last year, details the struggle to produce technologically competent graduates through the University of Regina's Teacher Education program. The goal at this time, as it continues to be, was to expose all graduating students to a varied representation of educational technology theories, research, resources, and pragmatics. Up until 1998, only the slight majority of students were able to take the offered "Computers in Education" class as an elective. Due to course limitations, many students were unable to fit the class into their programs. With the belief that "offering a single core course in computer technology for education might imply that computers were an 'extra' feature in education rather than an integral part" (Stevens, Lonberger, 1999), the Faculty responded with non-credit technology modules that became a requirement for all graduating students. The reasoning for this is to ensure basic computer competency for all emerging teachers of our program. The paper "Pedagogically Appropriate Integration of Informational Technology in an Elementary Preservice Teacher Education Program" (Maeers, Browne, & Cooper, 1998) shares with you those successes.

Faculty Vision and Instructional Technology Innovations

Only one year has passed since faculty members set forth our Faculty's vision for instructional technology In part, the visioning process listed key goals in the implementation of instructional technology. Such goals included the role of IT in several of the following areas: addressing diversity and equity issues, continued curriculum support, advanced web-quest & electronic portfolio development, WebCT (Web-based course tools) course development, and the revamping of the Faculty of Education homepage. Only one year later, great successes have been achieved in all of these areas. However, as technological integration undoubtedly is a moving target, our IT goals have also begun to shift towards higher expectations.

Current Goals and Developments

Goals and innovations in a Faculty of Education must be relevant for students and faculty, as there is a strong necessity to acquire skills and learning theory in order to effectively infuse technology into instruction. However, the path from here to there is not an easy one. In collaboration with the IT Coordinator, the Instructional Technology Committee (ITC) is interested in proposing a dynamic set of goals for the Faculty. The following is a short list of the renewed goals formed in an effort to increase technology competencies throughout the Teacher Education Program. Also included are goals which have not yet been proposed, but are being investigated as to their positive effects on the Faculty's IT future.

Technological Diversity at the Skills Based Level

Development, enhancement, and stimulation of information technology knowledge and skills of students and faculty in relation to operating systems, software applications, communications software, Internet and library resources, presentation software, instructional design software, and courseware, are to be fully realized. Faculty will also be able to use more specialized software such as test-generators, telecommunications software, grade managers, graphing programs, and databases in the execution of their personal and professional duties including professional development, teaching, research, and service. Both faculty and students will use technology, both hardware and software, as personal and professional tools. This will promote technology integration into the majority of courses as well as to promote faculty modeling constructivist approaches to instruction. To support this development, the IT coordinator will organize ongoing technical workshops to supplement the instructor's knowledge and skills base. In conjunction with workshops, faculty will receive continuing support in the guise of two dedicated Faculty of Education technicians, and frequent visitations and morale support by the IT coordinator.

Technology Diversity in Theory and Practice

Continued development of a theory-based approach to instructional technology implementation is absolutely necessary as a to serve as the backbone to all faculty IT proposals, research, service, and instruction. Moreover, this type of methodical implementation of IT is to be fully modeled, demonstrated, and understood by our pre-service teachers in order for them to take a careful approach to IT integration in their future careers and schools. Faculty and students must continue to consider carefully the works of learning theorists in conjunction with modern practical developers in Instructional Technologies. A communications model is essential here in developing, understanding, and applying theories into personal educational philosophies. This type of theoretical development is well served through continued development of our core classes (ECMP 355) and advanced classes (ECMP 490) in educational technology. Also, already three graduate studies classes have been offered which have an educational technology foundation, and there is continued development towards a graduate studies program specializing in educational and instructional technologies.

Support of On-Line Course Creation

Technical and instructional support of on-line, distance related and other, course creation for faculty featuring a variety of HTML editors, and especially WebCT, is strongly supported, and will continue to be supported in our Faculty. Support of on-line course creation tools will be thorough throughout the Faculty and will be adjusted accordingly to the goals and skills of the primary developer (faculty member). This support will include workshops in basic and advanced HTML, HTML editors, and WebCT development. For our technologically more prepared faculty, Java based development will also be offered and supported. Our Education technicians and IT coordinator are dedicated to support faculty ventures in web-based development to support instruction. Ongoing support in this area will lead to greater technological competencies for faculty, and with our careful regard to developmental principles, this will also lead to better, more diverse, instruction for our preservice teachers.

Essential Partnership with Library Services

The Faculty of Education has formed a partnership with the Education/Fine Arts library and Instructional Technology services in order to supplement and enhance course development and to provide basic and advanced instructional support. The Education/Fine Arts library has partnered with the IT coordinator and IT committee to provide the development of web, print, and multimedia instructional resources to supplement both terrestrial, and on-line course development. Also, through this partnership, there has been a provision for the development of a software media center where students and faculty are able to demonstrate the use of a variety of current media resources. In conjunction with this, library services will also catalog and provide educational software at request for faculty's use in the classroom, and for the students' use in their field experiences. In return, borrowers are required to both test and evaluate the educational value of the software. This will increase both accessibility and interest of instructional software, as well as providing proper assessment of such software's validity in formal learning situations.

Increased Exposure to Educational Technology Innovations and Practices

Through the office of the IT coordinator, the Faculty of Education will provide more opportunities for faculty and preservice teachers to be exposed to developmental practices in the areas of educational and instructional technologies. This exposure will be developed through two basic key strategies through on-campus and off-campus experiences. Software and hardware 'fairs' will be coordinated biannually. This will allow for the leaders in educational technologies and publishers or developers of educational software to show their 'wares' to the eager faculty and students. This will enhance the faculty's awareness of what innovations exist already and will allow students to experience the innovations first-hand rather than to have had merely a text-book or magazine approach to understanding technological innovation. Also, opportunities will be presented for faculty and staff to view instructional technology strategies in a school setting. This will occur by having either guest speakers (key administrators, educators, etc.) invited to speak about 'what they are doing in their classroom' in terms of technology and instruction, or moreso, to have students and faculty visit either on-site or virtually, where instructional innovation is actually taking place. This grounding of theories with practice will give faculty and students a better 'picture' of what is already available or what needs yet to be developed, and this will create an opportune environment for developing with, or against, already current technological practices.

Increased Course Development in Instructional Technology

Increased development in core classes of Computers in Education including an advanced class continue to be fully developed. Additionally, the development of instructional technology modules complete with dynamic on-line resources will continue to support the needs of all teacher education students. As the classes in 'Computers in Education' are not yet mandatory, the underlying principle of developing the courses and non-credit modules is to provide the opportunity for all preservice teachers to have a strong exposure to technology in instruction. This mandate is due to clear indicators that our school boards look first to hiring teachers who are able to develop innovative instruction in their classrooms primarily based on technology. This need is strongly evident in the requests from school boards, hiring agencies, and educators for graduate classes to be offered in educational technologies. The requests have already spawned three separate graduate courses in IT, and there is definite need to diversify in several more IT related areas. School boards are looking for candidates with a strong IT experience in the classroom, or in a practical setting. We try to offer our preservice teachers the best of both worlds.

Development of an Instructional Technology Development Centre

The development of an exclusive Instructional Technology Development Centre and Sampling Lab, complete with full multimedia authoring capabilities based on high-end multimedia workstations, will soon be fully realized. This Instructional Technology Development Centre will be developed in cooperation and consultation with media experts, instructional designers, and most importantly, experienced educators. The purpose of the center is to give faculty and students first hand experience and the resources to explore multimedia instructional design. The structure of the lab will be continually renewing so as to model most recent instructional technologies. In the development of the center, we will seek partnerships with multimedia design companies such as Macromedia and Adobe. Students will be able to sample, study, learn, and become proficient in specific lateral market software prevalent in the field of instructional and multimedia design. Parallel to this development, the Faculty of Education may seek to include graduate and undergraduate courses specifically geared to providing theoretical and practical foundations of instructional design. The tandem relationship of both theory in courses, and practical design in the lab components, will further supplement the faculty's overall IT goals, and will provide many students with a specialized background in one of the key areas of educational technology.

Partnerships with Industry, Telecommunication Providers, and Government Education

The Faculty of Education will explore the possibility of a partnership with Industry, local Tel-Co's, and Saskatchewan Education, with the purpose of developing a simulation distance education lab. This simulation lab will help to effectively train pre-service teachers in the methodological and practical processes underlying distance education delivery, as well as to help to have the students internalize the technical aspects of this emerging technology. Participants will be able to model and experience the benefits as well as the shortfalls of the various approaches to distance delivery. The lab will allow students and instructors to actually simulate both the sending and receiving experiences of a distance education environment. The design of the center will allow for the students and instructors to explore first-hand a diversity of opportunities in distance education fundamentals. Both the traditional delivery model for distance education will be explored, as well as the emerging communications model.

Continual Assessment, Evaluation, and Development of IT goals

The continual assessment of instructional technology needs and goals of the Teacher Education Program, both in terms of faculty and students, is essential. This assessment should be linked explicitly with the Saskatchewan Education needs assessment indicators, as well as with our Faculties' mandate for continuing excellence in our Teacher Education Program. The faculty must also look towards external sources to develop strategies in terms of instructional technology and related pedagogical practices even those that the local K-12 bodies have not yet embraced. Workshops, instructional strategies, and skills adjustments will be administered appropriately. Also, strong communication between school boards, provincial governing bodies, relevant national and international organizations, and educators is essential to our growth as a respected center for Teacher Education. In light of such rapid change and development in the field, the faculty will allow flexibility in the IT model. The flexibility is warranted in order to adapt to new instructional technologies as they emerge, and to help develop new technologies in teacher education. Inevitably, this will effectively allow for our Faculty to gain a place on the forefront of educational technology and Teacher Education.

Summary

There is no tried and proven method in which to develop technological competencies in our respective situation. In the world of educational and instructional technology, enduring expertise is an exceptionally rare commodity. We are forced to become leaders in our own right, and hope to share our story, whether successful or not, with other leaders and innovators. As our faculty is dedicated to the principles of effective education, they are flexible and accepting of this model of change. There is really no other choice but to remain flexible in this rapidly changing era. However, to be more effective in nurturing change, administrators must still be aware of common principles that apply to all types of education and professional development. We must still provide for our faculty and students a comforting and confident environment for evolution of learning to occur. With the increase of confidence in technology, there will be an unsuppressed, yet educated, growth in enthusiasm for the integration of technology into the classroom. It is when this enthusiasm becomes widespread, that we will see effective change and real integration of technology into the learning environment. However, confidence in technology is not easy to embrace. Confidence comes only after we can develop a significant infrastructure to support both the instructional needs and the technical needs of our faculty, staff, and students. The needs of both groups must be acknowledged through a diversity of approaches to gain an effortless self-assurance in which to succeed. When we are confident enough to accept our failures, we will be confident enough to succeed.

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Creating a Dynamic Model for Educational Technology in a Field-Based Teacher Education Program

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Absract: The program described below, Learning and Integrating New Knowledge and Skills (LINKS), addresses national, institutional, and teacher education goals as we prepare pre-service teachers to use a variety of technologies to enhance student learning. LINKS redesigns the teacher education program within the Professional Development School (PDS) at Texas Woman's University (TWU) to address the technology proficiencies desired by the schools, recommended by the National Council for the Accreditation of Teacher Education (NCATE, 1997b), and delineated by the professional technology associations. The project encourages faculty to explore new technologies and provide a model of technology integration in their curriculum delivery. It also builds the awareness of mentor teachers regarding the instructional possibilities of technology so that these mentors are more open to pre-service teachers who bring technology into their classrooms.

Introduction

The Teacher Education Reform Movement has been at the forefront of debate in colleges of education for many years, and questions about how best to integrate technology

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into teacher education programs are often at the center of this debate. Recommendations range from efforts to convince student teachers to use e-mail to programs designed to infuse technology into every aspect of the teacher education curriculum. E-mail, listservs, and electronic dialogue journals are a few of the recent innovations tried by teacher education faculty in attempts to combat the isolation that pre-service teachers often feel. Virtual workshops, out-of-field certification programs, and add-on technology courses have all been implemented with varying degrees of success. Finally, plans to integrate technology throughout the teacher education curriculum have been reported in increasing numbers over the past few years (Drazdowski, 1998; Parker, 1994; Schrum, 1998).

The efficacy of many of these efforts has been called into question. According to Shaw (1998) in his *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, "a large scale program of rigorous, systematic research on . . . educational technology . . . will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12 schools" (p. 115). In spite of these reservations, Shaw warns that "limitations in our current knowledge must not be used as an excuse to allow our schools to fall further behind other information-based institutions" (p. 125). Dusick (1998) and Roblyer (1998), among others, agree. While Dusick provides an egalitarian perspective arguing that computers must be placed in schools so that all students will have access (p. 12), Roblyer basically asserts that technology is here to stay whether or not we are prepared for it: "We have a multimedia future, the task at hand is to become fluent in our new native tongue" (p. 53).

If, as Shaw, Dusick, Roblyer, and others suggest, "speaking" technology is to become as essential as reading and writing, then plans that provide for the seamless integration of technology into teacher education programs seem most viable, at least in terms of society-wide impact. This paper describes one such effort designed to introduce pre-service teachers to educational technology within an integrated context of meaningful learning. This context is a field-based teacher education program, and the technology indicators are tied to specific requirements within that program. The program described below is supported by a U. S. Department of Education implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org).

The LINKS Program

The Learning and Integrating New Knowledge and Skills (LINKS) Program addresses the four goals of *Quantity*, *Quality*, *Equity*, and *Change* as we prepare pre-service teachers to use a variety of technologies to enhance student learning in rural, urban, and suburban settings. LINKS redesigns the teacher education program within the Professional Development School (PDS) at Texas Woman's University (TWU) to address the technology proficiencies desired by the schools, recommended by the National Council for the Accreditation of Teacher Education (NCATE, 1997b), and delineated by the professional technology associations. The project encourages faculty to explore new technologies and provide a model of technology integration in their curriculum delivery. It also builds the awareness of mentor teachers regarding the instructional possibilities of technology so that these mentor teachers are more open to pre-service teachers who bring technology into their classrooms.

These efforts are reflective of TWU's strategic plan as it relates to the preparation of future teachers and support for incorporating technology into higher education instruction and delivery. Technology integration is already an intrinsic part of the TWU PDS as students document mastery of specific technology skills within the context of required coursework. This integration will be further expanded through the implementation of this proposed LINKS program.

Current Technology Integration Program

The current technology integration program was developed based on the findings from the Basic Technology Competencies for Educators (Flowers, 1997) and has been an integral part of the Professional Education Sequence at TWU for the past two academic years. The four cornerstones of the technology integration program are (a) Foundations, (b) Connectivity, (c) Productivity, and (d) Integration. All pre-service teacher education students provide documentation of various skills related to these four areas as they progress through Intern levels I, II, and Residency. A brief description of the four areas and indicators of mastery is provided below. These areas are not intended to be mutually exclusive, rather they are integrated into the context of the field-based experience and requirements throughout the three-semester course sequence.

Foundations

This program component addresses knowledge of computing systems, develops basic skills for computer operation, examines the evolution of technology, and encourages users to begin to think with technology. Additionally, the social, legal, and ethical issues pertaining to technology use in an information society are addressed. Information Technology Service personnel and library personnel provide an overview of University technology resources.

Connectivity

During the beginning of their Professional Education sequence, this program component provides students with the information and skills needed to make both local and remote electronic information connections. Both the University system (Venus) and the use of a World Wide Web browser (Netscape) are utilized by students for e-mail and connectivity projects which include tele-mentoring, e-mailing assignments to liaisons, and communicating with other field-based participants through Web-pages, electronic bulletin boards, Web-based forums, and list-servs. Managing electronic documents and issues of netiquette and confidentiality are examined as well.

Productivity

This program component provides students at both Intern levels the necessary skills for teacher productivity. Intern I level students focus on word-processing, database use, and spreadsheet use. Intern II level students focus on advanced skills for teacher productivity and the integration of these skills into the curriculum. The use of desktop layout, graphics, and presentation tools is addressed at both levels.

Integration

The integration program component is delivered at both the Intern II and Resident levels. These students focus on learning theories and technology integration models, the examination of student technology tools (tutorial, simulation, exploratory, problem solving, and multi-media), and the integration of technology into various content areas. Advanced forms of media including optical technology, Internet resources, and related multi-media hardware and software are utilized in the creation of student projects. The use of global classrooms, on-line education, and distance education is included. Additionally, students learn networking skills, set-up and maintenance skills, and participate in planning for technology at the campus level.

Indicators of Student Achievement

Students in Intern I produce documents related to the development of teacher productivity skills (a parent letter, student database, and grading spreadsheet designed for individual field placements). Students learn how to discriminate between and evaluate various types of software. Students also describe the use of technology at their respective field sites including evaluation of software located at those sites. Students at all levels are required to email requirements and weekly reflections, and they must participate in a bi-weekly desktop conference group that extends discussion related to the required text: *Integrating Technology for Meaningful Learning* (Grabe & Grabe, 1998).

Students at Intern II and Resident levels produce documents related to the more advanced teacher productivity skills and integration of technology into the curriculum (a newsletter and the use of presentation software for lesson delivery designed for individual field placements). Students describe the technology use at their respective field sites and develop plans related to recommended modifications for a future technology plan at both the classroom and school-wide levels. This plan includes the evaluation of software located at each field site and a plan for implementation at the classroom level. After learning how to evaluate Internet resources, students design a WebQuest using advanced forms of media including evaluated resources. These projects are implemented at the respective school sites utilizing tools mastered in the previous Intern experiences and/or demonstrated during seminar classes conducted at the university. At all levels, students are required to attend a minimum of three lab sessions and six whole-group technology focus seminars which support the development of their skills in the four areas or relate to completion of the required indicators.

Role of Technology Seminar Leaders

This program is not a separate methods course. Instead it is an integrated aspect of the Professional Education sequence designed and delivered by technology facilitators who supports both the pre-service teachers and the instructors of the courses. Technology facilitators (a) provide additional resources and necessary background knowledge for Interns, Residents, and seminar leaders and liaisons through one-on-one support, small-group intervention, and whole-group training sessions; (b) make connections to the field site and provide support for mentor teachers; (c) utilize a course-designed Website for on-line instruction; (d) support desktop conference groups in discussion related to required text readings; (e) develop and conduct technology labs; (f) and document and certify technology competencies of Interns and Residents. As the program has grown to include more Interns and the variability of technology support in the field has increased, curriculum revision is needed to support implementation of this technology vision to a full-scale level at both the University and in field settings.

Proposed Technology Integration Program

The LINKS Program builds on the previously established program through full-scale implementation and is correlated with the PDS field-based education program. The planning for the PDS field-based teacher education program is structured around the Texas-adopted proficiencies for teachers. This includes the proficiencies which describe what teachers must know and be able to effectively demonstrate so that all children have access to quality education (TEA, 1995). The five proficiency domains are (a) Learner-Centered Knowledge, (b) Learner-Centered Instruction, (c) Equity in Excellence for All Learners, (d) Learner-Centered Communication, and (e) Learner-Centered Professional Development. These proficiencies provide the foundation for the Professional Development Appraisal System (PDAS)--the evaluative tool for all Texas classroom teachers.

The LINKS project utilizes this comprehensive and coherent structure to organize the passport tool that guides the pre-service teacher through documentation of technological competencies. These five proficiencies provide a basic structure for the LINKS Technology Passport. Upon declaring an education major (Interdisciplinary Studies) students are given a LINKS Technology Passport to guide them through identifying and documenting technological competencies. The specific competencies in the LINKS Technology Passport are grouped according to two categories--Essential Knowledge and Skills and Expanded Knowledge and Skills. The essential knowledge and skills section reflects the Texas Essential Knowledge and Skills (TEKS) competencies for students in the public schools K-12 (TEA, 1999). Since our teachers are expected to support the development of these competencies by the K-12 student, they must first demonstrate competency of these skills themselves.

The K-12 TEKS technology applications curriculum has four strands--foundations, information acquisition, work in solving problems, and communication. Through the study of technology applications foundations (including technology-related terms, concepts, and data input strategies), learners in public school settings are expected to make informed decisions about technologies and their applications. They learn to identify task requirements; plan search strategies; and use technology to access, analyze, and evaluate the acquired information. By using technology as a tool that supports the work of individuals and groups in solving problems, students will select the technology appropriate for the task, synthesize knowledge, create solutions, and evaluate the results. Students learn to communicate information in different formats to diverse audiences and to use a variety of technologies. The TEKS technology skills are included in the LINKS project as the *Essential Skills* to be demonstrated and monitored through the LINKS Technology Passport.

Building on the Essential Knowledge and Skills, and structured through the five proficiencies previously discussed, the LINKS project proposes a second category of technology competency focusing on *Expanded Knowledge and Skills*. This category is structured through three levels: (a) Productivity, (b) Connectivity, and (c) Integration. Both the Essential Knowledge and Skills and the Expanded Knowledge and Skills are delineated and documented in the Technology Passport.

The LINKS project implements this new technology curriculum founded on current standards which extend beyond productivity and connectivity to problem solving and integration into instruction at diverse levels and in various content areas. Performance in the new curriculum will be documented in the LINKS Technology Passport in which professors at all levels sign off on student mastery and/or performance of skills related to the technological competencies demonstrated as part of their courses. Students will be certified to be competent in these various areas through a series of benchmarks including one-on-one screenings and documentation provided throughout the professional education coursework sequence also recorded through the Technology Passport.

Significance

The National Council for Accreditation of Teacher Education (NCATE, 1997b) in its description of preparing for the 21st Century classroom emphasizes the need for a vision of a teacher education program which fully utilizes information technology. Such a vision requires major adaptations: (a) greater understanding of the impact of technology on our society, (b) new roles as authority over knowledge moves beyond the teacher and the classroom, and (c) emphasis on the ability to organize and interpret information and assess quality of information and sources in a reflective and critical manner. In order to accomplish such a vision, pre-service teachers must participate in courses designed to encourage the development of teachers as fearless users of technology (NCATE, 1997a). These courses must also offer an integrated and collaborative program that seeks to encourage this development through meaningful activities within authentic contexts. Some of these courses will encourage risk taking and lifelong learning through instructional delivery in non-traditional ways such as distance learning and on-line classes. NCATE further recommends that stimulating effective utilization of technology would include integration across all areas of the curriculum in the teacher education program.

"If the role of teacher education programs is to produce teachers who are able to use the new computer technologies, we must take our pre-service teachers from where they are when they enter and advance them to where the technological society needs them to be" (Sheffield, 1996, p. 52). Performance-based programs are measured in terms of competencies or proficiencies (Buhendwa, 1996; Flowers, 1997). Thus, educational needs at all levels can only be reached when our pre-service teachers are able to model the desired proficiencies identified in educational technology programs designed around an integrated teacher education vision. The LINKS program encompasses the integration of technology use as intrinsic to all courses leading to professional certification as well as within the professional education field-based courses. In the professional education field-based coursework, pre-service teachers complete their documentation of technology skills and knowledge, demonstrate their use in school settings, and utilize a variety of technology tools in teaching, evaluating, and communicating with diverse students in a variety of school settings.

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Building Capacity in Wyoming:
Preparing Preservice Teachers to Integrate Technology

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Abstract: This paper is a report on the Wyoming Capacity Building Project. This statewide project involves the State Department of Education, the University of Wyoming, and the seven community colleges in preparing perservice teachers to integrate technology. This project will build a foundation from which several systemic changes can occur within the delivery and curriculum of the preservice teacher preparation program. Three bodies of literature will guide the development of this foundation: the Concerns Based Adoption Model (CBAM), entrepreneurial leadership with technology, and systems thinking. The objectives are related to preparing and supporting UW and community college as they infuse technology into their courses and model the effective use of technology within their classrooms and their teaching methods. The overall goal of the project is to improve the quality of the preservice teacher preparation curriculum with a focus of preparing future teachers to use technology in effective, appropriate, and innovative ways.

Introduction

The over riding goal of this project is to improve the quality of the Wyoming preservice teacher preparation curriculum and prepare future teachers to use technology in effective, appropriate, and innovative ways. This project will build a foundation from which several systemic changes can occur within the curriculum and delivery of the preservice teacher preparation program. These systemic changes will increase the number of technology-proficient teachers graduating from the University of Wyoming who will be able infuse technology into their curriculum as a tool to improve student learning and achievement. As with any project of this magnitude, change does not come easily and the project team will utilize relevant theories and models from the change literature to guide our processes (Belasco, 1995; Fullan, 1991; Hall & Hord, 1987; Kotter, 1996; Rogers, 1983; Senge, 1990, 1999). Three diagnostic tools from the Concerns Based Adoption Model (CBAM) will be used to manage and facilitate the change processes within this project; Stages of Concern Questionnaire (SoCQ), Levels of Use interview (LoU), and Innovation Configuration Maps (ICM). Additionally, all stakeholders involved in the preparation of preservice teachers within Wyoming are part of the technology project consortium and will be involved in the project activities.

Project Vision

Vision plays a key role within any change effort by assisting to direct, align, and inspire all stakeholders participating in the transformation effort (Kotter, 1996). This vision needs to be imaginable, desirable, feasible, focused, flexible, and communicable. To be successful in transforming the preservice teacher preparation curriculum into a system that will prepare tomorrow's teachers to effectively use technology, our consortium must create a shared vision of the future of education in a technology rich world. The shared vision of this project can be stated as follows:

> To prepare tomorrow's teachers to use technology in effective, appropriate, and innovative ways through the infusion of technology into the preservice teacher preparation curriculum. These future teachers will have the skills and proficiencies to utilize technology as a tool for improving student learning and achievement.

This shared vision will serve three important purposes for the project consortium. First, the shared vision will clarify the general direction in which to make changes to the preservice teacher preparation program. Second, the shared vision will motivate instructors to take action in the right direction since the benefits and personal satisfactions will be far superior to those available without implementing the changes. Third, the

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shared vision will help to coordinate the actions of different instructors, departments, agencies, colleges and the University. This vision will be reviewed and communicated to all stakeholders of this project and will be refined as the project progresses. The project goals, objectives, and activities will support this vision and will help in communicating and supporting the vision to all stakeholders.

A project task force team will be selected to equalize the representation and opportunities for all stakeholders and to ensure the unique needs of each are addressed. Members will be selected to represent the university, community college, and K-12 stakeholders and will include representation from the educational community on the Wind River Indian Reservation. The University of Wyoming (UW) and Central Wyoming College (CWC) are engaged in a project to address the educational needs on the Wind River Indian Reservation. A critical need for the schools on the reservation is to recruit and retain teachers who have ties to the Arapaho and Shoshone tribes. UW and CWC are cooperating in the delivery of an off-campus program designed to lead to certification to teach at the K-6 level. Technology plays an important role in the delivery of this program and having a member from the Wind River Indian Reservation as a member of the project task force will provide valuable insights in equalizing and extending the impact of the project to other rural areas of Wyoming. The task force will have approximately 15 K-12, 11 community college, and 31 university members.

Project Goals, Objectives, and Activities

Goal 1: Conduct an assessment of current technology uses in the College of Education at UW, the seven community college campuses, and in K-12 Schools within the State of Wyoming.

Objective 1.1 – Develop a rich description of the levels of use of technology within K-12 schools, UW College of Education, and community colleges from the Levels of Use (LoU) interview data collected by the Wyoming Department of Education.

Objective 1.2 - Review the LoU data and compare the level of use of technology in K-12 schools with that of higher education.

The Wyoming Department of Education has collecting data from 112 K-12 educators on their levels of use of technology in their classrooms and is currently conducting the LoU interviews with higher education faculty during the fall of 1999. Additionally, Dr. Guy Westhoff, Assistant Professor in the Department of Adult Learning and Technology, University of Wyoming, will administer the Stages of Concern Questionnaire (SoCQ) to all higher education faculty involved in the preservice preparation program. The SoCQ will be used to identify the technology concerns of college faculty towards integrating technology into their courses and be used to guide activities in support the remaining goals of the project.

A fall Articulation Conference, held in Casper Wyoming during September 1999, launched the project and introduced participants of the consortium to the activities planned for the year. The project team worked with Wyoming educators in identifying national "best practices" and Wyoming practices that should ideally be integrated into the K-12 and teacher preparation programs.

Goal 2: Conduct a review of the preservice teacher preparation curriculum and the infusion of technology into these courses.

Objective 2.1 - Review the existing preservice teacher preparation curriculum and identify where technology is currently integrated.

Objective 2.2 - Develop a technology infusion matrix listing all courses within the preservice teacher preparation curriculum and the NCATE, ISTE, and state technology integration standards for teacher technology preparation.

Objective 2.3 - Identify where technology standards are taught across all courses.

Determining the current level of technology integration in the curriculum of courses offered within the preservice teacher preparation program will be accomplished through the activities relating to this goal and objectives. Faculty have been requested to submit a syllabus for each course they teach within the preservice teacher preparation program and to volunteer to serve on a review task force that will be headed by Dr. Ed Paradis, the Director of Teacher Education. The task force will meet five times during the academic year to discuss and conduct the review of the course materials. Results of this review will guide the task force in developing a technology infusion matrix that compares the technology skills addressed in each preservice course to the NCATE standards and the ISTE Technology Standard for Teachers. The task force meetings are planned for dates in September, October , November, February, and April. These meetings will utilize the technology infrastructure of the WEN and other existing systems and be conducted over the video conferencing systems, as well as face-to-face.

Goal 3: Develop recommendations for curricular revisions to improve technology infusion into the preservice teacher preparation curriculum.

Objective 3.1 - Develop recommendations for revisions to the preservice teacher preparation curriculum to reflect appropriate technology integration.

Objective 3.2 – Develop an Innovation Configuration Map (ICM) containing observable descriptors that represent what appropriate technology integration in a K-12 classroom looks like.

Data collected from the activities of goal two, review of the preservice teacher preparation literature, and participation in a curriculum and technology conference will be utilized to formulate the revisions to the preservice teacher preparation curriculum. These recommendations for revisions to the curriculum will focus on supporting the shared vision of the project and will benefit from the participation in the curriculum teleconferences and the Connections 2 Solutions conference described in the following section for goal four.

Goal 4: Design and develop a professional development program for college faculty to enhance the infusion of technology into the preservice teacher preparation curriculum for the State of Wyoming.

Objective 4.1 – Identify best practices for integrating technology into K-12 classrooms that support student learning and improved achievement.

Objective 4.2 - Develop a faculty technology-training program that emphasizes effective and appropriate technology integration techniques and methodologies to enhance the technology integration into the preservice teacher preparation curriculum.

All K-12 educators in the state of Wyoming and UW and Community College faculty involved in preservice teacher preparation programs were invited to the Connections 2 Solutions Conference, sponsored by the WSUP, and held October 20-21 in Sheridan, Wyoming. This conference presented a look at the future of technology in education and allow for discussions with, and presentations by, K-12 and higher education faculty that are using best practices to integrate technology into their classrooms and curriculum. Dr. David Thornburg, Director of the Thornburg Center for Professional Development, gave the keynote address and facilitated one-hour breakout sessions related to four groups: K-12 administrators; K-12 elementary faculty; K-12 secondary faculty, and higher education faculty involved with the preservice teacher preparation curriculum. These breakout sessions allowed faculty to discuss the factors that are most crucial to their level of instruction with each other and with Dr. Thornburg. While there is a great deal of commonality among the technology integration skills and techniques, the individual breakout sessions allowed all elementary, secondary, administration, and higher education faculty to discuss the issues unique to their level of students and their instructional strategies.

Goal 5: Implement the professional development program to prepare higher education faculty involved in preservice teacher preparation to utilize and infuse technology into their courses.

Objective 5.1 - Create a shared vision for the infusion of instructional technologies into college-level instruction within the preservice preparation curriculum that result in preservice students meeting or exceeding national standards.

Objective 5.2 - Implement the faculty technology training program to provide higher education faculty with the skills and methodologies needed to successfully infuse technology into their preservice teacher preparation courses.

The final goal of the Wyoming capacity building project will be to deliver a professional development technology-training program to the entire faculty involved with teaching courses within the preservice teacher preparation curriculum at the University of Wyoming and the seven community college campuses. This professional development program will be an innovative approach to preparing instructors to infuse technology into their classrooms and become role models for integrating technology to their preservice teacher preparation students. This professional development program will be designed to provide "just in time" technology training for all participants that matches the technology integration skills they currently need to improve their teaching.

The Center for Teaching Excellence (CTE) on the campus of the University of Wyoming will assist with the facilitation of this faculty development program and our corporate sponsors will assist in implementing the one-week professional development program. These training workshops will be delivered at three locations around Wyoming and will include the campuses of the University of Wyoming, Central Wyoming College and

Northern Wyoming Community College. Both community colleges have contributed the use of the technology facilities and training costs at their campuses for the one-week program as matching funds.

Conclusion

Accomplishing the goals, objectives, and activities of this project will assist faculty teaching within the preservice teacher preparation program integrate technology into their classrooms in appropriate, effective, and innovative ways. The natural extension of this project will be the development of a Learning Technology Plan for the preservice teacher preparation curriculum for the State of Wyoming. This proposed plan will assist in moving Wyoming towards a comprehensive effort of improving the preservice teacher preparation curriculum and will guide the development of an implementation plan for the revised curriculum and sustaining the professional development program.

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Technology Integration in Colleges of Education: Assessment and Planning

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Abstract: Responding to the call for faculty in institutions of higher education to model teaching and learning with instructional technology in undergraduate classrooms, the College of Education and Human Services at the University of Wisconsin Oshkosh submitted a successful application for funding under the auspices of the *Preparing Tomorrow's Teachers to Teach with Technology* federal grant program. As preparation for this proposal, the current state of the college was assessed using common factors identified in the 1998 Strudler and Wetzel that were identified as consistently moving institutions of higher education towards excellence in technology integration.

In 1995, the Office of Technology Assessment (OTA) published a study of four preservice teacher education programs thought to have exemplary approaches to integrating technology - Peabody College of Vanderbilt University, University of Virginia, University of Northern Iowa, and University of Wyoming. This study by Mergendoller, Johnston, Rockman, and Willis (1994) focused on issues involved in implementing the vision of technology infusion into programs. They noted the following consistent strands across the four universities: leadership at the dean's level to establish technological infrastructure and involve faculty in the use of educational technology; the ability to achieve "the somewhat tricky balance of establishing a culture that strongly encourages faculty technology use, but does not shame individual faculty members who lag somewhat behind" (Mergendoller et. al, 1994 Chapter 10); and preservice teachers at each institution experienced educational technology as an integrated part of their professional preparation across their coursework.

A follow-up study of these programs was conducted by Strudler and Wetzel in 1998 to further delineate the factors that consistently moved sites towards excellence in technology integration. In the recommendations section of their study these factors are enumerated. University of Wisconsin Oshkosh (UWO) used these factors to assist its faculty in determining needs that might be addressed by the catalyst category of the *Preparing Tomorrow's Teachers to Teach with Technology* federal grant program. A simple checklist was developed as follows:

Enabling Factor	**Achieved**	**On-Going**	**Not Observed**
College-wide factors:			
Establish college-wide technology committee	X	X	
Hire administrators who are committed, informed leaders		X	
Insure faculty participation in searches for administrators	X	X	
Be entrepreneurial - seek funding for innovative projects		X	
Make technology prominent in five year plans		X	
Hire faculty who are ready to use technology in their teaching		X	
Professional development factors::			
Students working with faculty			X
Workshops on integration			X
One-on-one learning opportunities			X
Incentives and awards for obtaining new tech and pedagogy skills			X
Hire curriculum integration specialists located in the college		X	

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Provide opportunities for this specialist to work with faculty			X
Embrace increased needs for access and support as a good problem		X	
Provide ample computer access and projection facilities in classrooms		X	
Student learning factors:			
Have students conduct informal technology inventory at beginning of any field experience			X
Plan for systematic integration of technology throughout the teacher education program			X
Consider giving a option of a second tier course for more advanced work	X		
Allow students option of requesting a technology-enhanced placement			X
Create a field-based component for the required technology course			X
Seek creative uses of distance technologies			X

Based on this basic checklist of enabling factors, it was evident that the College of Education and Human Services (COEHS) had laid good groundwork for technology-curriculum integration. COEHS at UWO made significant investments in both technology hardware/software and technology integration in the past two years. This focused on the new Classroom of Tomorrow lab, the creation of additional classrooms rich with technology teaching stations, and the successful hiring of faculty who are technology integration specialists with recent, successful K-12 teaching experience. Recently college wide interactions focused on the need for infusion of technology throughout the teaching and learning experience of all future teachers particularly in those courses where students acquire the subject area expertise they will use in their future classrooms and clinical experiences. Experimentation is currently occurring in team-taught social studies and math/science method courses with both curriculum-instruction and technology faculty members. However, this approach is limited by the number of technology faculty available and thus denies many faculty members this support.

COEHS supports the vision that its entire faculty will model new instructional strategies, multiple teaching-learning styles, and content applications that enable them to make full use of modern technologies for improved learning and achievement. To support this vision, the following needs were identified through use of the checklist based on the Strudler and Wetzel study: working with faculty on technology skills and integration strategies, opportunities for staff members who are curriculum integration specialists to work with faculty who desire their assistance, and expansion of the opportunities for tomorrow's teachers to acquire and observe technology-curriculum integration skills. Based on these needs the following program and objectives were proposed and funded under the initial round of the *Preparing Tomorrow's Teachers to Teach with Technology* grant project.

Project Design: Goal and Objectives

<table>
<tr><th colspan="3">Project Goal
To support faculty and tomorrow's teachers in the hands-on infusion of technology into existing curriculum and to provide opportunities for both to apply knowledge gained in field settings with practicing teachers</th></tr>
<tr><th>Objective</th><th>Outcomes</th><th>Assessment</th></tr>
<tr><td>1. Identify faculty interested in using powerful teaching and learning strategies that incorporate instructional technology</td><td>▪ 1/3 of faculty from UW Oshkosh College of Education & Human Services identified as first year grant participants</td><td>▪ Teaching styles survey
▪ *Stages of Concern Questionnaire*, University of Texas</td></tr>
<tr><td>2. Deliver workshops that model innovative teaching enriched with technology infusion</td><td>▪ 1/3 of faculty gain increased understanding of technology and curriculum integration</td><td>▪ Participant evaluation of workshop
▪ Bridge to practice</td></tr>
<tr><th>Objective</th><th>Outcomes</th><th>Assessment</th></tr>
<tr><td>3. Faculty, with appropriate support, develop and deliver</td><td>▪ 1/3 of methods courses model hands-on technology infusion</td><td>▪ Demonstration of project implementation by</td></tr>
</table>

curriculum projects rich with technology infusion	▪ Development of personal computer skills ▪ Curriculum modifications that model technology proficient instruction	artifacts (i.e. projects, simulations, multimedia materials, etc.) ▪ Reflection with larger group on successes ▪ Pre- and Post-Assessment ✓ *Computer Anxiety Scale*, Rosen ✓ *Attitudes towards Computers Scale*, Sears ✓ *Computer Thoughts Survey*, Weil
4. Tomorrow's teachers develop and deliver in their clinicals curriculum projects rich with technology infusion	▪ 300 students demonstrate technology integration in K-12 classrooms ▪ Faculty participate in K-12 classrooms ▪ Students developing leadership roles in clinical settings	▪ Demonstration of project implementation by artifacts (i.e. projects, simulations, multimedia materials, etc.) ▪ Written reflection on successes
5. Tomorrow's teachers observe current teachers who model exemplary teaching with technology	▪ 300 students observe ongoing innovative practice in classroom environment	▪ Guided observation form completion ▪ Roundtable discussions with methods classes
6. Tomorrow's teachers develop relationship with on-line mentor currently teaching in field who models exemplary teaching with technology	▪ Feedback and advice from current practitioner ▪ Reflection on practice	▪ Participation level/quality form from mentor teachers ▪ Count of interactions from website
7. Faculty and tomorrow's teachers will disseminate best practices to larger education audience	▪ Presentations at state level ▪ Presentations at national level	▪ Submission of proposals for presentations or posters ▪ Presentation/poster artifacts: projects, simulations, multimedia materials, etc.
8. Faculty and tomorrow's teachers collaboratively develop website to meet project needs	▪ Collaboration between educators in real-life problem centered need ▪ Website that provides focus for project objectives	▪ Formative throughout project based on emergent needs ▪ On-line suggestion/evaluation form

This project involves a consortium representing educators at all levels - postsecondary faculty, tomorrow's teachers, practicing teachers - participating together in a collaborative quest aimed at using new learning technologies for improved teaching and learning. The UWO as Local Educational Agent provides learning facilities, postsecondary faculty, and future teachers. Funding sought under the auspices of the Capacity Building grant is used solely for purposes of improving the teaching and learning of UW Oshkosh faculty and future teachers. However, a vital part of this initiative includes practicing teachers serving as role models in the field. Wisconsin's Cooperative Educational Service Area 6 (CESA 6), representing 42 districts, provides practicing teachers identified as innovative teachers using powerful teaching and learning strategies that incorporate instructional technology. These practicing teachers serve, in essence, as case studies for the undergraduate students in the successful integration of technology into the curriculum. Additionally, they function as mentors in curriculum development for future teachers, and as placement opportunities for clinical experiences. Funding for CESA 6 participation comes from an UW System grant, Wisconsin Regional Instructional Technology Support (WRITS). This grant works with exemplary educators who collaborate to develop constructivist, problem-centered curricular models designed to be presented as workshops to facilitate preK-12 faculty's understanding of technology/curriculum integration.

A core team of four faculty were selected based on the following indicators: identified as being independently successful in integrating technology into their methods courses, recognized as having worked collaboratively with other faculty and having shared with colleagues both through presentations and publication the results of their technology integration, and demonstrated their commitment to the redesign of the teacher preparation program through active participation in university-wide or college-wide committees, workshops and technology projects. It is the responsibility of the members of this core team to attend regular meetings with the project coordinator, provide technology integration workshops for COEHS faculty who commit to participation in this grant, serve as mentors and consultants on both an individual and group basis for faculty, supervise graduate assistants by acting as liaison with staff identifying needs and work schedules, identify opportunities for project dissemination, organize presentations of students and faculty at state and national levels, and maintain active participation in listserv activities of this grant.

Twenty-five faculty members volunteered to serve as grant participants. This represents almost half of the faculty involved with the teacher preparation program and includes faculty from both the COEHS, and the College of Letters and Sciences. Participants have a rudimentary base of personal computer skills, are faculty currently teaching in those areas where tomorrow's teachers receive their methods, content and clinical experiences, and share a commitment to pursuing new pedagogical learning and teaching methodologies. These twenty-four faculty members have committed to attendance at technology integration workshops as offered by the core team, to the development and deliverance of curriculum projects rich with technology infusion, to sharing and reflecting on questions, concerns and successes of projects with colleagues, to the construction of assignments which require students to develop and implement lesson plans utilizing technology/curriculum integration, and to moderate round table discussions with students after observation of either video or live case studies in technology integration. In the subsequent year, these faculty participants will serve as mentors for additional faculty members in the increased development of enriched technology-curriculum integration opportunities. All grant participants receive a library of resource materials on technology integration and will have input on the creation of a COEHS faculty library of software that will support their redesigned curricular plans (i.e. Tom Snyder cooperative software in the social studies, simulations and dry lab software for science, interactive fiction for language arts, etc.). They and their students will also have the opportunity to present work done under the auspices of this grant at statewide conferences.

The faculty grant participants are supported in their project development by the core team and grant coordinator. A series of four workshops presented by the core team have modeled constructivist, problem-centered curriculum utilizing hands-on approaches, just-in-time introduction of technology skills, and authentic assessment opportunities afforded by technology. Core team members are available to work with faculty members on identifying curriculum modifications that model technology proficient instruction. Additionally, three graduate students are supported by this grant and are assigned to faculty grant participants for one-on-one tutoring and problem solving. Faculty worked during the January 2000 interim to develop activities to be implemented in the Spring 2000 semester. They met individually with core team members twice during the implementation cycle and will meet once at the end of the semester as a group to share reflections, concerns, artifacts and successes of their curricular modification project.

Approximately three hundred students are actively involved in this project. Some represent future PreK-8 and Special Education teachers participating in Clinical A or B which are required block courses that integrate method courses with concurrent field experiences. Other future secondary teachers are participating in their Secondary Learning Community which presents subject area methods classes with concurrent field experiences. Additional future foreign language teachers come to the grant via their clinical and methods experience. These students are the first to experience the results of faculty curricular modifications in an effort to model new technology-rich approaches to instruction that require students to be active participants in learning while drawing on multiple sources of information to solve real-world problems in collaboration with others. They have the advantage of designing technology-rich lesson plans to be implemented immediately in their clinical field settings thus serving as potential leaders in the PreK-12 schools.

It is vital to the success of prospective teachers that they have case studies to observe current practitioners using technology/curriculum integration methodologies and constructivist theory in real world settings. Towards this end, the innovative teachers selected for the CESA 6 WRITS grant will serve as case studies by allowing themselves to be videotaped and subsequently critiqued by prospective teachers and faculty. CESA 6 personnel will also be instrumental in identifying technology-rich sites for student placements to meet clinical field experiences.

Students have the opportunity to work with a mentor via email with practicing educators who currently employ innovative learning theory with technology-rich instruction. All students involved in methods coursework with concurrent field experiences are assigned to a mentor. These mentors may be located in Wisconsin and be participating in the WRITS project but it is equally likely that students may be assigned to an out-of-state mentor. Students may engage mentors in discussions about educational practices, technology integration, reflective practice, or use the mentorship as an opportunity to discuss integrating technology in working with diverse student populations.

All of these various approaches to restructuring teaching and learning at the postsecondary area require a central focus area. To provide this focus, faculty and students will collaboratively develop a website for this project. Responsibility for envisioning the site by analyzing needs and perceived ways the web could meet those needs will lie solely with the grant participants. A storyboard will be drafted to design the site, its pages and purpose. Design and layout issues will be considered. Faculty will use Claris HomePage to develop the core of the site; student consultants chosen from the methods classes will do subsequent completion and revision of the site.

Finally, dissemination of the results of the grant project as a whole and the results of curricular redesign have been considered. An ongoing view of the project through posting of activities, timelines, philosophy, and purpose will be available through its web page linked to the UW Oshkosh site. Proposals for presentations regarding the Capacity Building grant, methodology and outcomes will be submitted at the Governor's Wisconsin Educational Technology Conference and at other appropriate statewide conferences such as Wisconsin Council of Social Studies, Wisconsin State Reading Association, Wisconsin Council of Exceptional Children, etc.

Conclusion

This grant project, Development of Instructional Technology for Tomorrow's Teachers, will enable the UWO's College of Human Services and Education to make significant movement towards addressing both the *quantity* of tomorrow's teachers who actively participate in coursework enriched with the use of technology and the *quantity* of today's postsecondary faculty who are integrating technology into their coursework. It will assure the *quality* of that experience by encouraging thoughtful reflection on both the part of tomorrow's teachers and post-secondary faculty on the role of technology in society, its vital infusion into schools and its fundamental impact on restructuring the traditional model of learning and teaching at all levels. Finally, it will address the issue of *equity* for students through the preparation of tomorrow's teachers to work in the surrounding 42 school districts representing an area serving a population that is approximately 62% rural in nature, with 11% minority students, 19% low income students, and 7% students with Limited English Proficiency.

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Tec to Take: An Innovative Strategy for Supporting Preservice Teachers During Field Experiences

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Abstract: Meeting the resource needs of preservice students during their field experience practica is not a new problem. The tec to take project is designed to provide appropriate resources for integrating technology into instruction by addressing the problem of readily accessible resources for technology enhanced instruction. The project is based on a collaborative model which includes the preservice student, the faculty supervisor, the class room mentor and the school based technology coordinator. The opportunity to check out equipment and software (tech to take) is based on a written instructional plan for the integration of the resources into a field based classroom lesson or unit of instruction.

Introduction

Computer to student ratios have declined steadily from 50:1 in 1985 to 20:1 in 1990 to an estimated 9:1 in 1997, affecting traditional classroom practice and even the culture of the schools. The computer, video, and telecommunications of various kinds are having an impact on every aspect of our society: work, leisure, entertainment, household tasks. These inventions are also transforming the way we approach knowledge and sources of expertise. Today, people are no longer required to read about an event; they can see media versions of it unfold before their own eyes and make their own interpretation. Consequently, the ability to obtain and interpret information quickly and accurately is even more important than in the past.

There is no longer a question about whether the new technology will be used in schools. Nearly everyone agrees that students must have access to computers, video, and other technology in the classroom. Many believe these technologies are necessary because competency in their use is an important feature of career preparation; others see equally important outcomes for civic participation. Most importantly, a growing research base confirms technology's potential for enhancing student achievement. What is less certain is how and when these technologies will change the nature of schooling itself.

Arthur E. Wise, President of the National Council for Accreditation of Teacher Education states in the Technology and the new Professional Teacher: Preparing for the 21st Century Classroom, 1997:

> Two million new teachers will be hired over the next decade. Will these new teachers be comfortable and skilled in using technology? What will it take to transform schools of education so that faculty feel comfortable e-mailing students, using listserves for projects and instruction, and introducing candidates to software that enhances instruction? As technology moves from the periphery to the center in P-12 schools, so must it move from the periphery to the center in teacher preparation.
>
> Teacher education institutions must prepare their students to teach in tomorrow's classrooms. Rather than wait to see what tomorrow's classrooms will be like, they must experiment with the effective application of computer technology for teaching and learning in their own campus practice. Today's teacher candidates will teach tomorrow as they are taught today.

Research has long indicated that future teachers take their cues from the practices they observe in classrooms during teaching practica and internships. If students are taught the latest technology uses as part of their teacher education programs, but don't see effective technology practices in the schools, they are unlikely to incorporate technology use in their own teaching. Schools are powerful socializing agencies that greatly affect new teachers' perceptions about what does and what doesn't work in practice.

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The introduction of computers and other technologies into schools is occurring at the same time that three decades of research in the cognitive sciences, which has deepened our understanding of how people learn, is prompting a reappraisal of teaching practices. We know from this research that knowledge is not passively received, but actively constructed by learners from a base of prior knowledge, attitudes, and values. Dependence on a single source of information, typically a textbook, must give way to using a variety of information sources. As new technologies become more readily available and less expensive, they will likely serve as a catalyst for ensuring that new approaches to teaching gain a firm foothold in schools.

Despite the technology changes in society, being a teacher in American schools too often consists of helping children and youth acquire information from textbooks and acting as an additional source of expertise. Teachers are provided role models of this approach to teaching from kindergarten through graduate school; their teacher education courses provide hints for making textbook-oriented instruction interesting and productive, and as teaching interns, they both observe and practice instruction based upon mastering information found in books.

The question raised is “how must teachers adapt to take advantage of technology for instruction? In the 1997 National Council for Accreditation of Teacher Education report on preparing the Professional Teacher for the 21st Century the following paradigm shifts are recommended:

New Understandings

Teachers need to understand the deep impact technology is having on society as a whole: how technology has changed the nature of work, of communications, and our understanding of the development of knowledge.

New Approaches

Today, teachers must recognize that information is available from sources that go well beyond textbooks and teachers - mass media, communities, etc. and help students understand and make use of the many ways in which they can gain access to information. Teachers must employ a wide range of technological tools and software as part of their own instructional repertoire.

New Roles

Teachers should help students pursue their own inquiries, making use of technologies to find, organize, and interpret information, and to become reflective and critical about information quality and sources.

New Forms of Professional Development

Teachers must participate in formal courses, some of which may be delivered in non-traditional ways, e.g., via telecommunications; they must also become part of ongoing, informal learning communities with other professionals who share their interests and concerns.

New Attitudes

Finally, teachers need an "attitude" that is fearless in the use of technology, encourages them to take risks, and inspires them to become lifelong learners.

More than in the past, teachers must become advisors to student inquirers, helping them to frame questions for productive investigation, directing them toward information and interpretive sources, helping them to judge the quality of the information they obtain, and coaching them in ways to present their findings effectively to others. This will require teachers to become even better prepared in the content of the subjects they teach, and the means by which the content can be taught and learned.

In light of paradigm’s stated above, the next question to pose would be “what changes need to be made in teacher education programs to foster the teaching skills for the 21st Century educator?”

Technology can also serve as the catalyst for reconsidering the entire architecture of teacher education: e.g., how, when, and where candidates will acquire the knowledge and skills they need; and the linkage between preservice and in-service professional development. The integration of technology should be accomplished in relation to other efforts to reform teacher preparation, not as a separate reform initiative.

The literature provides an awareness of the pervasive need for a new type of educator. To prepare educators to meet the challenges of the 21st Century classroom will require the development of preservice models that take advantage of community, public school and higher education partnerships in a technology enhanced environment. Research has documented that few teachers fully exploit the use of computer based technologies (Hunt & Bohllin, 1995). The need to be able to understand the compatibility of computer based technologies and newer research based approaches to teaching and learning such as inquiry based learning, performance assessment, and constructivist curriculum are needed for the quality teacher (Bracey, 1993, Campoy, 1992)

How does the tec to take program facilitate the professional development related to technology integration for the preservice student, the field based mentor and the faculty supervisor?

The following steps will illustrate the tec to take project process.

Step one: *A learning community is formed between the preservice teacher, field based mentor, and faculty supervisor (for example a preservice student is linked together with a fourth grade teacher and a university faculty supervisor together they collaborate and identify an instructional topic)*

Step two: *The learning community identifies an instructional topic that would be suitable for the integration of technology into the instruction (for example grade four graduation standard related to a study of States)*

Step three: *The learning community identifies the types of hardware, software, and corresponding workshop experiences that they need to effectively implement the technology enhanced instruction (for example the learning community may decide that an appropriate technology component related to the study of States might be to do a community self study utilizing digital cameras, building of a report web site, and cooperating with another school in another State who might be doing a similar project. To be successful, the learning community may need to complete instruction related to digital cameras, web development, and identification of web sites with classroom link projects.)*

Step four: *Submit a request for a tec to take kit that would include the appropriate hardware and software to accomplish the stated instructional goals of the field based project.*

Step five: *Implement the lesson/unit with a field based classroom (for example, the preservice teacher in collaboration with the field based mentor and the university supervisor would prepare the materials and plan the lesson outlines that would address the instructional needs of the State project.)*

Step six: *Assess the student learning as a result of the technology enhanced lesson (for example, the learning community would determine the quality of the learning experience for the fourth grade students. Student satisfaction survey's as well as evaluation of student products related to States would serve as artifacts of the quality and level of student achievement of academic goals.)*

Step seven: *Reflection by the learning community of the success of the technology integrated instruction (the learning community would review the student achievement outcomes and the management processes of the instruction. Following this review, recommendations would be made for additions or modifications of the instruction for future planning.)*

How does the tec to take process address the new paradigm recommended by the 1997 National Council for Accreditation of Teacher Education report on preparing the Professional Teacher for the 21st Century ?

New Understandings

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By working in learning communities, the representation of the beginning through the mentor level teacher gives these educators an opportunity to consider alternatives to traditional teaching strategies. The workshops that correspond to the instructional plans provide the opportunity for the educators to learn new skills as a team and apply these skills to an actual classroom experience.

New Approaches

The learning communities will collaborate and review instructional strategies that take advantage of newer instructional technology resources. Because the field based teacher may face curriculum requirement restraints, one of the outcomes of the tec to take program is to support the learning community to identify ways to augment existing curricular goals utilizing technology resources.

New Roles

The instructional technology lessons reflect the consultant, constructivist classroom model. As noted earlier this is the type of instructional model that teacher education programs are advocating in their preparation classes. In order to "break" the cycle of traditional instruction the availability of model field teachers that embrace this approach to instruction is critical for field based placement of preservice teachers. It is anticipated that the tec to take will provide all members of the learning community an opportunity to expand their skills with the student centered style of teaching.

New Forms of Professional Development

The tec to take reflects a continuous need to not only learn how to work effectively with school district curriculum requirements, but also the need to continue to learn how to use new technology based hardware and software. The proposal request process for being able to use the tec to take resources supports professional development by offering software and hardware orientations for the learning communities to assure optimal use of the tools by the educators.

New Attitudes

The learning community model, the use of appropriate instructional technologies, and the ongoing expectation of professional growth is reflective of the career long professional development model advocated by the National Council for Accreditation of Teacher Education as well as the National Teacher Standards Board. The tec to take teacher education program provides a framework for the identification, field testing and reflection of technology enhanced instruction.

Summary

The tec to take program is designed to provide a focus for the creation and implementation of model technology enhanced instruction. Because this approach to teacher education practica is based in a field classroom, several levels of learners benefit from the projects. The preservice teachers has an opportunity to work with real students and utilized recommended teaching strategies and instructional technology resources, the university faculty and field based mentors have an opportunity to work collaboratively in the creation of model field sites for the preservice student and at the same time develop and or expand their instructional technology knowledge and expertise, and most importantly, students in the field based classrooms will have an opportunity to benefit academically from the instructional technology enhanced learning experiences.

Reform in education must begin with the type of educator in the classroom. All of the dollars spent on resources and equipment will do little to alter the day to day realities of the learning process unless preservice and inservice teachers begin to have opportunities to learn "new ways" to conduct the business of education. Initially, the reform will need to be made in the context of the present day to day curriculum. Teachers have minimal time for the inclusion of dramatically new content areas and instructional practices. By developing teacher expertise related to the appropriate use of instructional technology via the augmentation of existing practice they will no longer see technology as an "add on" experience rather a natural way to conduct and manage the instructional process. Once teachers gain a comfort level with technology new applications will emerge that transcend the augmentation of traditional instruction.

The tec to take is just one way of providing resources for both the beginning and field teachers. It is the project goal that by providing the hardware, software, and skill development support that the beginning and field based educators will be motivated to try out technology enhanced instructional approaches without the concern of limited resources or lack of knowledge for successful implementation of the instruction. It is the goal of this program to foster a supportive learning community environment that models the continuous professional development of educators. This project is built on the philosophy that we are all collaborative members of a community of learners, all with expertise and knowledge contributions ,as well as needs for new knowledge and skills.

Keeping our Perspective: Technology as Tool

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Abstract: Technology is prime among educational buzzwords on the cusp of the millennium. Not only have schools scrambled to qualify for beneficial e-rates to support connectivity; a group of Philadelphia educators has sought approval to operate a virtual k-12 educational organization. Despite technology's high profile, just one in five of the 2.5 million teachers currently employed in public schools is comfortable with its use, according to a current U.S. Department of Education finding. Are teacher educators the usual suspects? Just five years ago, NCATE claimed that most teacher education faculty neither modeled technology use, nor taught prospective teachers to use instructional technologies; recent research agrees. The contention in this paper is that, in order to enjoy respect in the academic community, technology must be seen, as neither toy nor trophy, but as a custom tool integral to curricular purpose.

Technology is surely among "the" buzzwords characterizing conversation on educational reform as the century turns. Not only have schools scrambled to qualify for beneficial e-rates to support their connectivity; a group of Philadelphia educators has sought an e-charter, or approval to operate a virtual k-12 educational organization. The White House Web Site features the challenge of technology literacy, and OERI publications include lengthy lists of URLs supporting professional development of educators to promote such literacy.

But, despite technology's high profile on the cusp of the millennium, a recent national survey by NCES (Lewis et al, 1999) found that only 500,000 of the 2.5 million public school teachers currently teaching consider themselves comfortable in using technologies. Are teacher educators the usual culprits? Just five years ago, NCATE (1995) admitted that the "majority of teacher education faculty do not model technology use, nor do they teach students how to use information technologies for instruction." More recent research by Moursund & Bielefeldt (1999), confirms the sense that technology evolves more rapidly than the ability of teacher educators to make meaningful digital applications in their teaching. Yet, McNabb et al (1999), in a U.S. Department of Education technology planners handbook, cite studies which conclude that "the success or failure of technology depends more on human factors than it does on hardware or software." Clearly, our work remains unfinished.

The contention of this paper is that, in order for technology to enjoy the respect it deserves in the academic community it must be seen as neither a toy nor a trophy, but as a custom tool integral to curricular purpose. In this context, the manner in which we employ technology in teacher education is critical, since the admonition to, "Do as I do, not as I say," is ever present. Our mantra, of utilizing best practice research, calls us to honor, for example, active learning, learners' multiple modalities, and coherence between objective and activity. Further, best practice contends that technology is transparent in good learning situations. Freestanding technology study seems wrong-headed; its inclusion should serve the higher purpose of improving learning. Nevertheless, "Many faculty seem to view technology as a separate type of content, rather than as something that should or could be integrated", again according to NCATE (1995.)

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Having once required a separate media course of prospective teachers, faculty at our institution have moved their conversational questions from, "What pieces of equipment must students know how to operate?" to, "How do we most appropriately develop preservice teachers' ability to effectively promote learning in technologically rich environments?" The distinction is significant, as is the conclusion of the national working group convened by the Milken Exchange on Educational Technology which emphasized that the teacher's ability to successfully integrate technology relates to knowledge of the learner and the learning environment as well as to technology competence. (Mc Nabb et al, 1999) In our own experience, the primary faculty task seems to lie in defining--and redefining--reasonable competencies for future educators.

With or without technology, we want our future teachers, for example, to conduct research; to engage in situated problem solving; to select learning resources consistent with objectives they identify for their own students; to design learning experiences for students with varied modalities; to promote reflection on their own instructional practice. Insofar as technology can offer expanded opportunity for implementing such goals, it is critical to set technological expectations for the preparation of skilled professionals. The challenge becomes one of recognizing the technology in the true sense of a tool for enhancing human potential.

To illustrate the point, we consider several of the major student objectives, as each is enhanced by technology.

To Conduct Research

It is idealistic to believe teacher preparation programs can provide all the information prospective teachers will need to solve the instructional problems they may encounter in the classroom. It is realistic to expect that future educators will leave teacher preparation programs armed with the skills necessary to fulfill the role of teacher as researcher. In an introductory education course, students gain an understanding of this often unfamiliar role through the investigation of a realistic problem situation. Students are required to seek out additional information on the issues involved. Many different options for obtaining data are explored and discussed but inevitably, someone will suggest searching electronic databases and the web. Using a research question, students design and test searches, a task which ultimately leads to discussion and questions on search techniques and appropriateness of materials. As a follow-up activity, students have the opportunity to attend a workshop on database/web searching techniques.

To Design Learning Experiences for Students with Varied Modalities

"Learning style is the way in which individuals begin to concentrate on, process, internalize and retain new and different academic information." (Dunn et al, 1995). Proponents of the learning styles movement believe, in order to maximize learning, there must be a congruency between the educator's teaching syle and the learning style of the student. While research on learning styles has come under criticism, best practice suggest incorporating a variety of strategies into a lesson will enhance the learning experience for all students. Prospective teachers who deliver presentations that incorporate overhead transparencies and/or utilize presentation software or incorporate video clips into a lesson to motivate young students about a topic in science education are demonstrating their knowledge of the importance of making learning more accessible to visual learners.

To Engage in Situated Problem Solving

Given the emphasis on promoting higher level thinking, it is imperative that teacher education programs assure the involvement of their candidates in authentic or contextualized problem solving. While this can be accomplished by such time-tested methods as using written stimulus materials, such as case studies, the implementation of digitized video scenarios created by Vanderbilt University's Cognition and Technology Group offers considerable advantages. Prospective teachers who solve mathematical problems from the Adventures of Jasper Woodbury value such qualities as realistic video stimulus, complex "word problem" content requiring minimal reading skill and random video access permitting immediate retrieval of essential information. Insofar as teacher candidates learn how to utilize this technology, they have mastered an additional resource for promoting problem solving with middle grade students, and not only developed the skill of operating digitized video.

To Select Learning Resources Consistent with Objectives

Evaluation of resources in terms of their instructional fit has long been an expectation for teachers. Professional journals abound with descriptions of trade books that complement thematic study, for example. In its present iteration, this crucial task of professional judgment must embrace not only print and video, but also cyber sites and software. Regardless, the quality of the judgment rendered is prime. Students initially report delight in finding abundant sources of prepared lesson plans on the Internet, but determining what the plan purports to do, for whom, and how well, requires more sophisticated critique. The same principle, that assessment occurs within a context, holds for software review. The action of professionally selecting materials with the best potential for fulfilling learning objectives links us to best past practice, while the introduction of representative new technologies enriches the repertoire of beginning teachers.

In mathematics education, for example, we can provide opportunity for future teachers to examine significant variations. The Math Forum's Ask Dr. Math serves a very different purpose than some of the more colorfully animated commercial sites. Prospective teachers benefit when contrasting the usefulness of LCSI's Logo-based MicroWorlds as a geometric tool for problem solving and creative-critical thinking, against a fact practice staple such as MathBlaster. Similarly, they should be able to discern the advantages of graphing tools in a mathematics situation.

To Promote Reflection on Their Own Instructional Practice

Essential for the success of committed professionals is the habit of self-examination. Teachers must not only plan learning opportunities for youngsters of diverse talents and needs, they must also assess the effectiveness of their implementation. Listening carefully to learners' discourse and studying work products are two of the many ways of gathering useful information. Indeed, analysis of student misconceptions has a long history in providing significant feedback to instructors.

Video technology offers another tool for reflection. We have found that our prospective teachers place real value on the artifacts which video cameras produce. Two upper level courses require oral presentations followed by questions and answers. Peers write informal constructive comments based on criteria specified for this purpose. Having had brief instructor-provided operating instructions, students record their peer's presentation on video, so that the individual has yet another perspective for reflection. Within a week, students submit a written analysis of their work, using both peer and video feedback. Then the instructor adds her evaluation. Invariably, despite acknowledging the increased pressure imposed by the recording, students applaud it as an independent source. In cases of poorly organized presentations, or those in which eye contact was fleeting or absent, the viewer often realizes the weakness before any word from peer or instructor. But in happier cases, students report satisfaction in realizing that they appeared more composed, or more fluent than they expected would be the case. Having seen and heard their work, they often afford more credibility to the insights offered by others!

Final Thought

As we reflect on the competencies we value for prospective teachers we do so mindful of the fact that teacher educators must be committed to modeling appropriate integration of technology. If we design and implement learning experiences that recognize technology as a tool for enhancing human potential, then, hopefully, future educators will begin to "do as we do".

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Preservice Teachers as Constructivist Producers and Critical Consumers of Technological Resources

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Abstract: This presentation outlines a constructivist approach to educational learning and work for preservice teachers which enables them to move from passive consumers of information to active producers of technological resources for themselves and others. This approach involves secondary methods preservice teachers as critical consumers utilizing a FileMaker Pro™ 3.0 database that has been customized to gather text, graphics, sound, video, and references through the World Wide Web. The preservice teachers then become active producers by applying that information in lesson activities that are made available to others through technology. Mounting lesson activities by preservice secondary teachers from a common site has resulted in a community product or new information bank of over 50 activities in 9 topical areas: English, social studies, science, journalism, guidance, art, math, special education, and business education.

Introduction

In his discussion of the importance and dignity of work, Boyer (1995) states that "life, for all of us, involves producing and consuming" (p. 99). Although it is possible in today's world for an educator to do a great deal of consuming without producing anything original, teachers need to engage in both activities to maintain self-esteem and to assume their places as professionals in a learning community. Technology helps educators balance producing and consuming through the World Wide Web by giving them the tools "to explore, experiment, construct, converse, and reflect on what they are doing, so that they learn from their experiences" (Jonassen et al., 1999, p. 194).

While World Wide Web tools are very valuable, educators at all levels who use the Internet face an explosion of information for which they need strategies to shape work, save human energy, and focus power. Fortunately, technology users can access such forces through databases or information banks to help them do just that. Information banks, according to Jonassen, Peck, & Wilson (1999), "may include text documents, graphics, sound resources, video, animations, or any other medium of information that is appropriate for helping learners understand the content well enough to be able to use it to solve problems"(p. 199). These information banks supplement the efforts of a human by taking advantage of the superior sort and compile functions of a computer to manage information and to search a topic or keyword in minutes, sometimes even seconds. Beyond speed, the foray of a database also produces work in research and information management by its capacity to move easily among any number of indexed fields.

Approaching databases initially and using them effectively can be daunting for preservice teachers as they struggle to learn and integrate content, pedagogy, and technology all at the same time. Yet Morton (1996) asserts, "computer systems in school should be viewed as structured learning environments with complex and comprehensive capabilities.... They should be seen as interactive learning extensions of the children themselves" (p. 417). The same could be said for the computer systems of the children's teachers. This perspective acknowledges the constructivist nature of a technological learning environment as well as validates and encourages teachers at all levels to see themselves as active contributors to a community of learners who share knowledge and ideas through the World Wide Web.

Active Production of Technological Resources

This presentation outlines a constructivist approach to educational learning and work for preservice teachers which enables them to move from passive consumers of information to active producers of technological resources for themselves and others. This approach involves secondary methods preservice teachers as critical consumers utilizing a FileMaker Pro™ 3.0 database that has been customized to gather text, graphics, sound, video, and references through the World Wide Web. The preservice teachers then become active producers by applying that information in lesson activities that are made available to others through technology. Mounting lesson activities by preservice secondary teachers from a common site has resulted in a community product or new information bank of over 50 activities in 9 topical areas: English, social studies, science, journalism, guidance, art, math, special education, and business education.

Before we can operationalize the constructivist approach to critical consuming and active producing, we ask preservice teachers to seek World Wide Web resources on a curricular topic in their subject area in preparation for lesson planning and presentation. The information knowledge base available through technology is expanding so rapidly that novice users can easily be overwhelmed. Both teachers and students must understand and feel comfortable with technology in order to tap its strength to address individual needs and specialized lesson activities. McLellan (1996) defines this type of shift as "mass customization—customizing both education and technology to individual learner needs and preferences" (p. 5). At this point in their education, preservice teachers are both learners of content and pedagogy with individual needs, and future teachers who will soon be faced with the individual needs of their own students. Technology is truly valuable only when users, like our preservice teachers, are able to assess and transfer information and processes to new situations.

Following an introductory lesson reviewing navigational strategies using a Web browser, we distribute a handout with the address and brief annotation of a number of search engines and educational sites. As preservice teachers begin to find specific materials, their questions and comments reveal that they are ready to learn how to select and download resources. At this point, we discuss thoroughly how to evaluate the credibility and usefulness of World Wide Web resources. Preservice teachers' conversations then turn to how they can use some of the materials in their classrooms. By the end of the two-hour session, students report that they feel confident about exploring the Internet for materials to use in curriculum development and teaching, and they are ready for the Three-Step Approach to Information Organization to focus those resources.

Three-Step Approach to Information Organization

The Three-Step Approach to Information Organization blends technology applications with constructivist strategies to enrich both approaches. In theory, constructivism describes the changes in students' mental schemes that illustrate learning. Planning constructivist activities that involve technology activities requires teachers to consider the following components of practice:

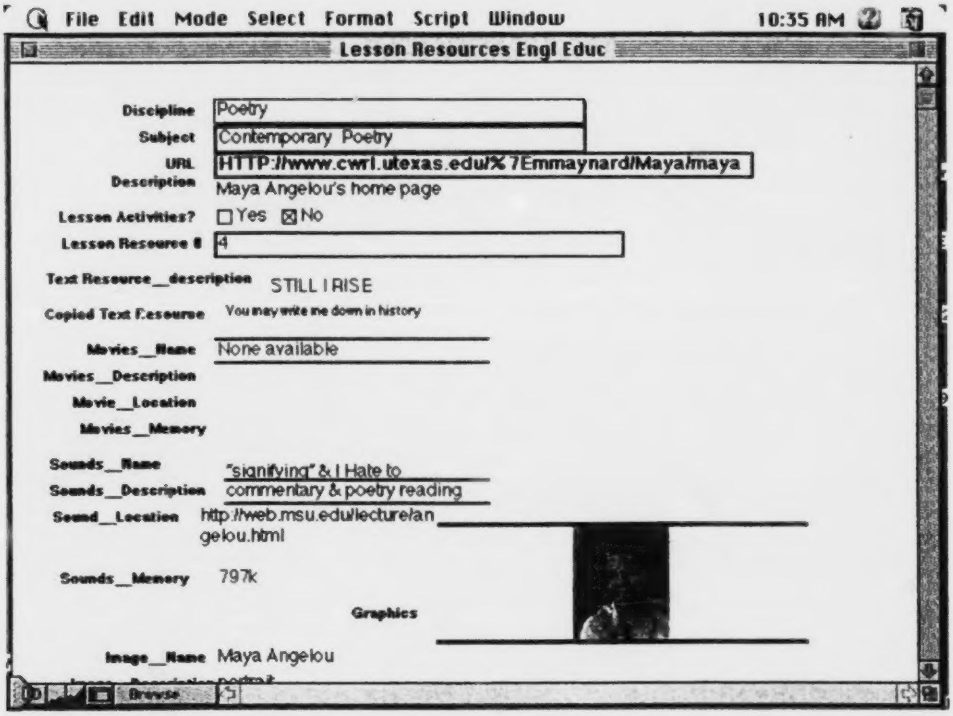
- Lessons should be based on the evolving needs of students
- New information offered within a lesson either confirms or changes students' current beliefs
- Teachers must value students' perceptions of and reponses to lesson information and activities
- Lessons must establish relevance for current and future use

Today, teacher educators must expect students of education to be intellectuals—problem-solvers who resolve cognitive dissonance, perform authentic activities, and have their efforts assessed in ways that reflects a genuine application. The Three-Step Approach to Information Organization meets these criteria by completing the tasks outlined below.

Step I--Critical Thinking Assignment: Students begin this assignment by finding and downloading resources from at least five World Wide Web sites into a Teaching Resources Database that will aid in the development of a lesson activity in their subject area. This assignment reinforces their new skills in navigating and retrieving from the Web, storing, and organizing information. It also helps students understand that quantity does not equal quality, and information does not equal insight.

Step II--Authentic Activity Procedures: Constructing meaning involves evaluating information by sorting and sifting, saving only what is important. This authentic activity builds on a process most of us learned as part of our first research paper assignment--indexing cards. With the help of technology, we can take that process and update it by having students build their own Teaching Resource Database on a hard drive or disk, directly cutting and pasting information from the Web to the database instead of downloading files without careful analysis. The development of a lesson activity using the database makes it personally relevant and a professional resource that one could continue to expand. See Figure 1 to for fields and database layout.

Figure 1.: Teacher Resource Database Layout


File Edit Mode Select Format Script Window
10:35 AM
Lesson Resources Engl Educ
Graphics
Browse

Discipline Poetry
Subject Contemporary Poetry
URL HTTP://www.cwrl.utexas.edu/%7Emmaynard/Maya/maya
Description Maya Angelou's home page
Lesson Activities? ☐ Yes ☒ No
Lesson Resource # 4
Text Resource__description STILL I RISE
Copied Text Resource You may write me down in history
Movies__Name None available
Movies__Description
Movie__Location
Movies__Memory
Sounds__Name "signifying" & I Hate to
Sounds__Description commentary & poetry reading
Sound__Location http://web.msu.edu/lecture/angelou.html
Sounds__Memory 797k
Image__Name Maya Angelou

Using an alternate layout within FileMaker Pro™ 3.0, the student can quickly and simply produce handouts or mini-posters of the materials for teaching.

Step III--Published Products: Performance testing of an authentic activity should be nonalgorithmic, complex, and involve judgment and interpretation (Resnick, 1987). By publishing the product of their searches, preservice teachers are authentically challenged to use World Wide Web resources to create a new resource. This new resource is then available for analysis, comment, and use by other professionals in the field. Like all publication, this step encourages preservice teachers to do their best work because the published resource is also available for potential employers to review at the following World Wide Web site address: http://www.educ.drake.edu/sec_meth/secondary.html.

These published products include the following categories: resources needed, exposition, procedure, interactive learning, critical thinking, possible assignment, and World Wide Web resources used within the activity. The secondary lesson activities can present concepts that might be familiar in new and different ways, but they are all based on resources found on the World Wide Web. For example, one lesson activity, "Adaptation in Arctic Conditions," explains the concept of thermoregulation with a lab about how to make blubber. Students are divided into cooperative learning groups that explore the insulating effects of blubber in Arctic conditions. Critical questions are provided for students as they consider the concept. In addition, the page includes a complete lab activity outline and corresponding worksheet. Visitors to this page are sent to a number of World Wide Web sites for further information:

- *How do animals spend the winter?* http://www.waterw.com/~science/november.html

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- *Adaptations for an aquatic environment.* http://www.seaworld.org/walrus/adapaqwal.html
- *Polar bear facts.* http://www.polarworld.com/polarfaq.html
- *Polar bear project and information.* http://www.polarworld.com/help.html

All of the lesson activities are launched from a table on the secondary methods web page. Submenus by discipline list activities and their authors. Links from the activity title lead directly to the students' pages, their contribution back to the educational community and the World Wide Web.

Benefits of a Constructivist Approach to Technology

Using a constructivist approach to technology accepts learners as thinkers with valid questions and the ability to create meaning and materials. The benefits of this approach, when properly applied, enrich learning and teaching in the following ways:

- The formulation of questions and assessment of materials can enhance critical thinking and problem solving. Using information obtained from a variety of sources and creating meaningful products to illustrate student learning enables all, teachers and students, to increase their knowledge base and apply that knowledge to new circumstances with emerging technologies.
- Authentic technological activities provide for individual needs and learning styles of students by offering different methods of learning a concept. For example, students might make a video, create an electronic presentation, prepare a concept map, and even use word processing to write a traditional research paper. The important point is that all of these activities are prepared as they would be in a work world.
- Autonomous learning is promoted as students question, explore, and create meaning that arises out of their own unique educational needs and interests. Autonomy is best represented by initiative and creative energy. While technology cannot guarantee that students will succeed, it does motivate them to undertake projects and to persevere in refining them. Such perseverance can then increase self-esteem and satisfaction from intrinsic motivation.
- Collaborative learning in technological situations creates a team atmosphere and produces problem solvers even as it expands human networks. Both Dewey and Vygotsky stress that we naturally learn in social situations. Students working in technology share skills, knowledge, shortcuts, and encouragement with other students on site or with persons across the world through e-mail, chat rooms, and forums.
- Multiple approaches and perspectives allow the student to explore diverse viewpoints and synthesize information critically. Learning with technology reflects the complex nature of knowledge, encouraging the acceptance of knowledge as tentative and tolerance of ambiguity.
- Real-time relevance mirrors our rapidly changing society and its hunger for information about events as they occur. Instant access through technology to newsgroups, electronic publications, and online news reporting provide an active learning environment that facilitate transfer of information quickly.
- Innovative learning environments provide a work-world approach to managing and leading educational innovation. Classroom teachers cannot stay current in all aspects of technology that can be useful to them. They must establish environments where continued learning is modeled and reinforced, and an environment where risk-taking is encouraged.

Hindrances to a Constructivist Approach to Technology

As with any technological process, a constructivist approach to technology can create challenges that act as hindrances in its implementation.

- Time can be a real concern when blending technology with a constructivist methodology. Technology approaches take time to set up and require time to teach both the technological skills needed and the targeted concept. In addition, students require varying amounts of time to construct authentic projects.
- Inequity of resources perpetuates socioeconomic divisions. Lockard, Abrams, & Many (1994) assert that "Computers only call further attention to the fact that schools in the U.S. are anything but equal. Inequities affect everything from basic supplies such as paper and pencils to library resources and even the quality of teachers" (p. 411). The problem is magnified when students from schools with few resources go home to an environment unable to support their technological needs.

- Teachers who have limited knowledge and interest in technology either refuse to use technological approaches or use them ineffectively. Use of technology requires new ways of thinking about instructional delivery. Roblyer et al. (1997) confirms "that properly trained teachers make the difference between success or failure of an integration effort" (p 40).
- Besides the initial cost of establishing technology, schools are faced with continuing cost of repairing and updating equipment and software. Innovations are soon outdated, and newer equipment and software are often incompatible with existing resources.

Conclusion

Preservice teachers with a dynamic need for resources can find or produce a plethora of information. But educators also have a need for a process which enables them to organize and synthesize that information so that it is meaningful as well as useful for current and future projects. The constructivist approach to critical consuming and active producing described in this paper provides proactive procedures for preservice teachers to search, sort, save, synthesize, and create.

Future questions about this approach deal with the ability to sustain and update the site, staying current with database software, and the use of the customized database after students have left the university. We have had contact with former students who are now teachers who look to the Web site for new ideas and indicate that they continue to use the database template that was given to them. Moreover, even if they do not have the same software at their schools, they do have knowledge of the process of evaluation, information gathering, and synthesizing so that they can create their own databases. Using a customized database in a constructivist approach to technology provides a means for students to act as critical consumers and to contribute as producers for the educational community of learners who continue to work with and through technology.

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Learning Practices In Amsterdam

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Abstract: The Amsterdam Faculty of Education is developing and implementing a new curriculum concept for professional education, for which it attained the status of "the experimental teacher education in the Netherlands" in 1997. This concept, fitting in the constructivistic learning paradigm, is nicknamed 'learning through producing'. The Amsterdam Faculty of Education (EFA), which attained the status of "Experimental College of Teacher Education" in the Netherlands through a national contest in 1997, is developing a radically new curriculum concept. In this poster/demonstration session a number of concrete results, as well as the basic ideas behind this curriculum innovation, are demonstrated in an interactive fashion.

Introduction

The Amsterdam Faculty of Education (EFA), which attained the status of "Experimental College of Teacher Education" in the Netherlands through a national contest in 1997, is developing a radically new curriculum concept. In this poster/demonstration session a number of concrete results, as well as the basic ideas behind this curriculum innovation, are demonstrated in an interactive fashion.
A more extensive presentation of these basic ideas can be read in the SITE 2000 paper "Proving Competence: Integrative Assessment and Web-based Portfolio System in a Dynamic Curriculum", by Douwe Wielenga.

The development and implementation ("expedition", as we call this process) of this new curriculum, is our answer to the challenge of educating teachers for the information society, in which they will have to act as "change agents" of education.
Education should, in our view, take place in a learning environment that reflects the way a professional works: students, like professionals, work together on complex tasks. In doing so, they take control and responsibility of their own work and learning processes. Also, this approach makes learning exiting and challenging: learning can, once again, be fun!

Authentic Learning in Professional Education

At as early a stage as possible, the program should create an environment for students which mirrors professional practices. Learning during the program must be linked as far as possible to useful and responsible work resembling work in the profession for which one is being trained.

In professional practice, teachers have to carry out relatively complex tasks that fit in with the objectives of the school. To be able to do this useful work well, they must be able to use 'two kinds of learning'. They should not only be able to acquire on their own initiative the knowledge and skills they need to do their job well (learning of the first kind), but they should also be able to continue to learn from the experience gained and to experiment systematically with actions leading to improvement or change (learning of the second kind). See figure 1 on the next page.

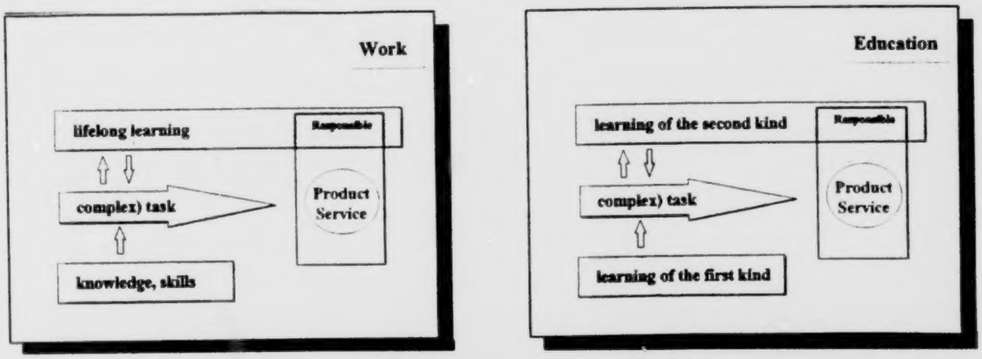

Figure 1: congruence between work and education

Both kinds of learning are important in the concept of 'lifelong learning'. Both are 'guided' by the competencies, which the competent and qualified teacher must have.

So the program should offer environments in which students can (and indeed should) put these two kinds of learning into practice connected to authentic practical work, in order to acquire the skills required for the profession. In this concept, named "learning through producing", we integrated ideas on authentic and meaningful learning, first and second order learning, integrated assessment, and portfolio systems. ICT is used, not as an "add on" technology, but as a catalyst of the curriculum transformation. The key building blocks in this curriculum, and the main subject of this session, are "authentic learning practices", which differ radically from traditional courses. Students work together on complex assignments: they provide products or services, preferably for the professional field, schools for primary and secondary education. In many instances, working for schools involves support in innovation and ICT-implementation in these schools. Students acquire knowledge and skills in order to perform the tasks, set in such an assignment. They are being encouraged to take responsibility of their own learning process by basing student's assessment mainly on the quality and usefulness of the products that they make. Of course that assessment is not solely based on products, but explicitely on the proof of professional competence that is given by the sequence of products, feedback and reflections.

Basic characteristics of these learning practices are:

- Students work on meaningful, authentic assignments; someone (e.g. a school) depends on their products! Students acquire the competencies of a professional teacher by working in consecutive learning practices.
- The student takes control of, and is responsible for, his own learning process. Within the framework of the assignment, the student has the freedom to set his own learning aims.
- The teacher (faculty) acts as a coach in both the learning and the productive processes.
- The learning practice encompasses a full learning cycle, including orientation, planning, execution and evaluation activities. Assessment of students is based on their products as well as on their reflections on the learning process.

Examples will be shown at the poster session. Examples can be seen at http://onderwijs.efa.nl. Information in the English language on the expedition of the Amsterdam Faculty of Education can be seen at the Publications part of the home site of EFA: http://www.efa.nl

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The Multimedia Content Development Company: The Evolution of a Hands-On Technology Integration Course for Preservice Teachers

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Abstract
This article describes a strategy for modeling the integration of technology in the curriculum of ETC 447, Technology in the Classroom, a required course for preservice lementary educators at Northern Arizona University. Preservice teachers engage in a classroom simulation in which they "do" desktop publishing, databases, spreadsheets, and hypermedia development--not just hear about them or complete practice activities. The strategy can be modified and implemented at any K-Higher Ed level. Included are samples of the course materials from the course Web site, as well as examples of student work. Although we are currently using ClarisWorks 4.0 in a Macintosh-clone computer lab, the coursework is platform-free and any of a number of applications can be used.

Introduction and Some History

Don Tapscott, in *Educating the Net Generation* (Educational Leadership, 1998) recently says of the K-12 environment, Computers alone won't do the trick. They are a necessary but insufficient condition for moving our schools to new heights of effectiveness. We've still got to learn how best to use this technology. And I have become convinced that the most potent force for change is the students themselves. (p. 7)

This, we think, is also true of preservice teacher education at the university level. One of the difficulties in changing the way educators "do" things may be that our educational system is one in which the new generation of teachers is taught the same way as the last--it is self-replicating. New teachers enter the system from teacher education programs with similar beliefs and experiences as their predecessors; thus, they continue to teach the way they were taught! For change to happen, preservice students need to experience alternative teaching and learning models and strategies as part of their own education.

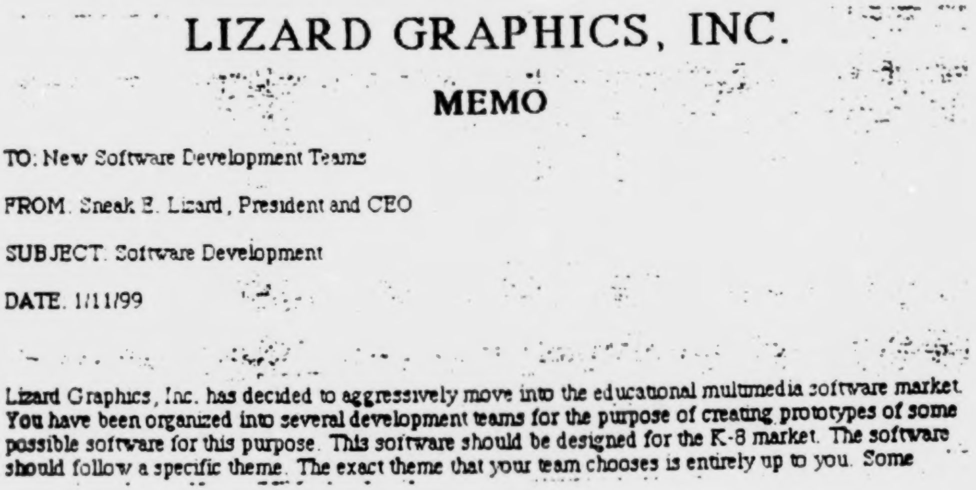
ECI 447 has been a required technology course for all elementary preservice teachers in the Center for Excellence at Northern Arizona University for over 7 years. It has evolved from a skills-based course where students completed a variety of projects by following instructions in a manual, to a classroom simulation of a Multimedia Content Development Company where teams of students complete a content-centered project in which technology tools are integrated.

At its inception ECI 447 was taught in a lab of Apple II Es which grew, over the years, into first, a lab of hybrid Macintoshes, and now one of 22 Motorola Macintosh clones--equipped with printers, scanners, Proxima display unit, digital cameras--linked together on a network that includes mounted CD-ROM software, student and instructor folders, and fast access to the Internet and World Wide Web.ECI 447 has become ETC 447 with a prefix that denotes its true goals and objectives, Educational Technology for the K-12 curriculum.

It has been our vision to move from ETC 447 from one in which students followed the traditional computer literacy curriculum of drill and practice routines and activities with little personal engagement in the course materials, few higher order thinking expectations, and, frankly, not much enthusiasm, to one that models authentic practice through hands-on activity and social interaction, enabling our students to "do" technology and "be," for example, authentic desktop publishers and multimedia developers and database managers by using those tools in an environment that promotes risk-taking and personal responsibility for learning. We watched our students plow through the textbook to complete the projects and we graded their papers, and we felt that ETC 447 was hollow: our students gave us good evaluations as helpful and supportive instructors; they reported that they learned alot, but there was no evidence that they had experienced technology in a way that they could take with them into their own classrooms, the real world, to use effectively---they had only "covered" the material.

Strategy for Technology Integration: The New, Improved, I Really Mean It This Time, ETC 447

We have spent several semesters struggling with ETC 447 to move it closer to our vision, adding group work here and new activities there, but finally, over the 3-week winter holiday in December 1998 we looked at each other, said "Let's do it!," and spent our semester break completely recreating the course. For the Spring 1999 semester we introduced **The Multimedia Content Development Company** to ETC 447 students with the following memo taken from the course web site (http://jan.ucc.nau.edu/~emw4/etc447). This memo serves as the introductory piece for an in-depth 10-week project, and models a contract strategy, both between students, and between instructor and students, in which activities, expectations, and completion dates are noted.



LIZARD GRAPHICS, INC.

MEMO

TO: New Software Development Teams

FROM. Sneak E. Lizard, President and CEO

SUBJECT: Software Development

DATE. 1/11/99

Lizard Graphics, Inc. has decided to aggressively move into the educational multimedia software market. You have been organized into several development teams for the purpose of creating prototypes of some possible software for this purpose. This software should be designed for the K-8 market. The software should follow a specific theme. The exact theme that your team chooses is entirely up to you. Some

FIGURE 1. The Sneaky Lizard Memo

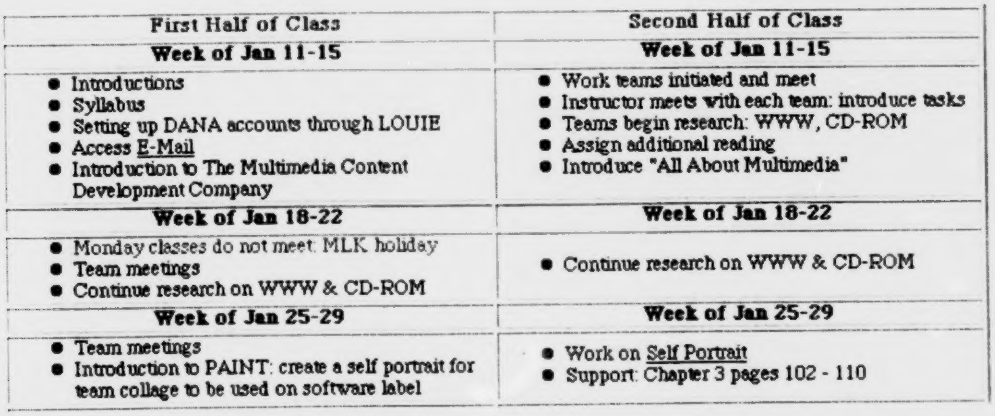
Materials for ETC 447

The first week of class meetings (we have 8 sections of ETC 447 on campus taught by four instructors, some that meet once a week and some that meet twice) was spent introducing the course web site and carefully examining each document of the **Multimedia Content Development Company**. The materials that traditionally would be part of a course syllabus are all available at the web site and include

(1) the syllabus
(2) the competencies (what product instructors expect from each activity)
(3) the grading structure for the course
(4) the schedule for the semester

At the web site, too, are all project materials, such as
(1) the memo that introduces the **Multimedia Content Development Company**
(2) Research Help--lists Web sites for all kinds of research
(3) a description of each team member's responsibility
(4) Resources for graphics and educational Web sites
(5) Search strategies for "surfing" the Web

Each instructor, that first class meeting, used their own method to place students in teams for the project. ETC 447 classes are limited to 20 students, so teams of 4 were planned. Each student then chose a responsible team position, i.e., the Recorder, who keeps track of what goes on at each weekly meeting of the Team, or the Presentation Coordinator, who is responsible for making sure the final presentation is completed and ready for a wider audience of CEE faculty and students.



First Half of Class	Second Half of Class
Week of Jan 11-15	**Week of Jan 11-15**
• Introductions • Syllabus • Setting up DANA accounts through LOUIE • Access E-Mail • Introduction to The Multimedia Content Development Company	• Work teams initiated and meet • Instructor meets with each team: introduce tasks • Teams begin research: WWW, CD-ROM • Assign additional reading • Introduce "All About Multimedia"
Week of Jan 18-22	**Week of Jan 18-22**
• Monday classes do not meet: MLK holiday • Team meetings • Continue research on WWW & CD-ROM	• Continue research on WWW & CD-ROM
Week of Jan 25-29	**Week of Jan 25-29**
• Team meetings • Introduction to PAINT: create a self portrait for team collage to be used on software label	• Work on Self Portrait • Support: Chapter 3 pages 102 - 110

FIGURE 2. The Semester Schedule

During that first week, too, each instructor spent extra time with the 4-person teams to review the concept of the project, helping them to decide on a research topic, and answering questions about team-member responsibilities. This proved to be an important element of the introductory process, for instructors and students. We were able to meet and talk with each other in a small group environment: students were able to have discussions with people they were expected to collaborate with, and the instructors were able to put faces with names across a table instead of across a room.

The Multimedia Content Development Company Unfolds

In those small groups the students made their topic decisions and, for the next two weeks, were encouraged to concentrate on their research--on the Web, in the university library, and on CD-ROM encyclopedias available in the computer lab.

Research topics included The Planets, The Four Food Groups, Greek Gods, Animals of Northern Arizona. Time for thinking, planning, and research is often at a premium in the classroom, whether at the university or K-12 level. We wanted to model the importance of allowing time for these higher-order skills in order for students to have the best opportunity for success.

In the third week, following their research, the MCDC teams began working on the project. The first activity, using PAINT, was for students to design and create a self portrait. (We use ClarisWorks 4.0, now AppleWorks by Apple Computers, on Macintoshes in our lab, but students' are encouraged to recognize the concepts, not the platform, and use other applications and platforms that are also available to them.) These self portraits will be electronically merged to become the cover of their team portfolio. This activity was designed to support and model several levels of learning: the tools available in a PAINT application, the integration of technology in a content-based project, and understanding artistic challenges and possibilities for K-12 classrooms.

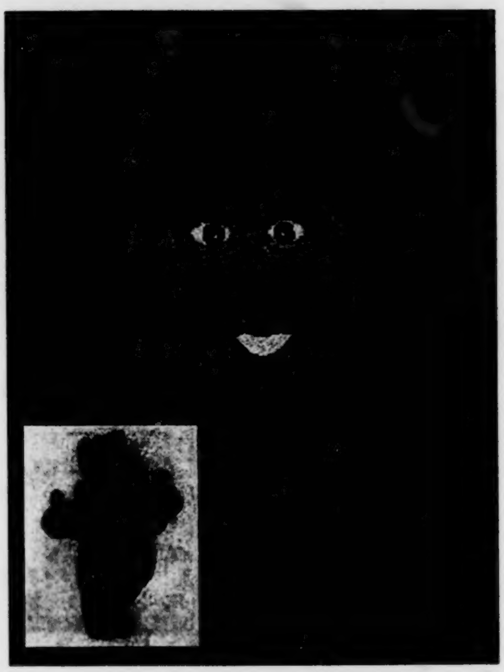
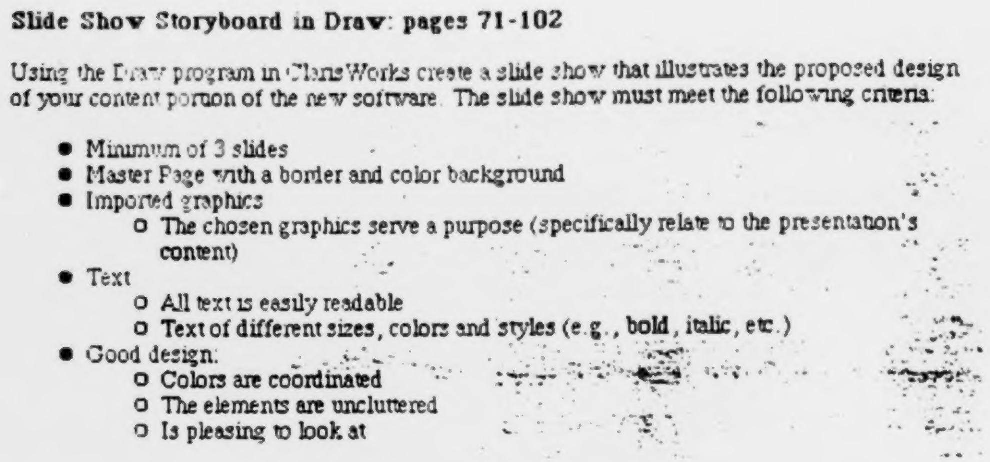


FIGURE 3. Student Self Portrait

To complete the next activity, students created a slide show using the ClarisWorks 4.0 DRAW application, the storyboard planning for what will eventually be their hypermedia document about the research content they have chosen. They learned the DRAW tools and concepts, how to set up a slide show for use in their own classrooms, and played with design elements such as object placement, color, and text.



Slide Show Storyboard in Draw: pages 71-102

Using the Draw program in ClarisWorks create a slide show that illustrates the proposed design of your content portion of the new software. The slide show must meet the following criteria:

- Minimum of 3 slides
- Master Page with a border and color background
- Imported graphics
  - The chosen graphics serve a purpose (specifically relate to the presentation's content)
- Text
  - All text is easily readable
  - Text of different sizes, colors and styles (e.g., **bold**, *italic*, etc.)
- Good design:
  - Colors are coordinated
  - The elements are uncluttered
  - Is pleasing to look at

FIGURE 4. The Slide Show Competency

The completion of the Multimedia Content Development Company project includes the research content and computer-based activities in which students:

create one-page newsletters about their research for a team prospectus.

create 10-person databases, with a mail merge of three professors to whom they will send invitations for the final presentation.

create spreadsheets to explore expenditures for software, hardware, and visiting content experts needed for their software development.

design and create a 15-20 card team hypermedia document that synthesizes the individual content research and becomes their software, to be showcased at the final presentation.

And, finally, the teams present their completed project to "the company president," their peers and invited guests--a wider audience. The presentation is both a hard-bound portfolio of completed work, such as their newsletters and spreadsheets, but also an electronic showing of their hypermedia content "software." Team members are responsible for securing a presentation room, electronic display carts, planning the order of team presentations, and making sure all the technology "works"—everything that must be done in the "real world." During this presentation teams are also be responsible for videotaping each other for self-critiquing. The constructive self-criticism from viewing the videos allows these preservice teachers a unique opportunity to "see" themselves as presenters and help prepare them for Arizona's video-based performance evaluations for educators.

Conclusion

A recent article in Education Week (October, 1998) reports that technology can have positive benefits in the classroom, but that too often it is used for the wrong purpose. The researcher, Harold Wenglinsky, an associate research scientist at the Educational Testing Service, used performance data from the 1996 National Assessment of Educational Progress (NAEP) to investigate the relationship between educational technology and students' achievement in mathematics. What he found, among other things, is that in 4th and 8th grade "students whose teachers had professional development in computers outperformed students whose teachers didn't." (p. 13) And, furthermore, eighth graders who used mostly "simulations and applications--generally associated with higher-order thinking" (p. 13), rather than drill and practice, performed better on NAEP than students who did not. In fact, "8th graders whose teachers used computers primarily for "drill and practice"--generally associated with lower-order thinking--performed worse." (p. 13)

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We don't know yet how ETC 447 students will evaluate this innovative course format--only time will tell. But, for us, the "new, improved" ETC 447 not only meets the stated objectives for our technology curriculum for elementary preservice teachers, but satisfies our vision of what that course should look like in order to model good practice in utilizing technology tools for higher-order, relevant, and engaging activities, hands-on technology integration, and be more than "let's turn the page and follow the steps... drill and practice until you get it right." From the results of Mr. Wenglinsky's study, we think we are at least on the right track.

Restructuring, redesigning, and recreating ETC 447 has been time-consuming and labor-intensive. Thinking and planning for meaningful technology integration is a challenging task, but watching and listening to students work together to make a cooperative decision, or engaged with a problem around a computer, it is worth every effort we make. Moe than that, if we, at the university, preservice level of education, expect to make changes in the way technology is used in the K-12 environment, we must be models for our students, willing to be innovative and risk-taking ourselves, to explore new strategies, methods, and technologies.

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Acknowledgements

Our thanks to Gary Karcz and Dave Bowman, adjunct instructors at CEE, for their willing assistance in redesigning ETC 447 and implementing it immediately in their course sections. We would also like torecognize George Howington, System Administrator for the computer lab, who always says "yes" when we ask for one more extra drop folder on the network, or access to another software application. And thanks, too, to the graduate assistant and lab techs who support our ETC 447 students during open lab time.

Resources

ClarisWorks 4.0, now AppleWorks, www.Apple.com

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AN INNOVATIVE TEACHER-TRAINING COURSE INCLUDING THE INTEGRATION OF ICT: THE EXPLO PROJECT OF THE ICHTHUS UNIVERSITY

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Abstract: The Explo project of the Ichthus University trains primary school teachers with vision and skills in the handling of ICT. Explo is a new, experimental teacher training course, related to the Dutch government's Prommitt program (see also Panel session). Explo is meant to be an educational response to the challenges posed by the knowledge society. One of these challenges is that both pupils and students must be prepared for the learn-as-they-work concept of organizations. Another challenge is that ICT plays a key role in these developments. The first part of this paper explains the view of Explo on the use of ICT in education. The second part deals with the Explo course in detail and gives information on the course program.

The role of ICT in education

Computers are used in education in numberless ways:

- As sources of information, such as educational software, CD-ROMs, on-line catalogs and databases on the World Wide Web;
- As means of communication such as e-mail, electronic news and discussion groups, computer conferencing and video conferencing;
- As tools for making products, such as word processors, data bases, presentation programs, author systems, programming languages, etc.;
- As tools for data analysis and process simulation. ICT applications in education are virtually inexhaustible, but not all applications are equally opportune in each study program, for each student and at each point. Having to make choices, it is important for us to establish the relevance of ICT to education.

The digital world is an extra world

The digital world with e-mail, the Internet, multimedia software and other electronic aids considerably increases the number of ways we process information and communicate. Besides being a playground and a market square, the Internet is used intensively as a working and learning environment. The "web" is not only an oracle, but also a tool shed to design and construct things. It's not only a means of storage and distribution for educational materials, but also a publication tool for students. It's not only a coaching and consultation channel, but also a virtual space for cooperation and discussion. There are three reasons why education should familiarize itself with this new learning environment, firstly: to teach pupils how to use the possibilities of ICT in a meaningful rather than superficial way, secondly: to enhance pupils' learning competence and thirdly: to prepare pupils for professions in which the use of ICT is increasing.

The computer as the students' tool

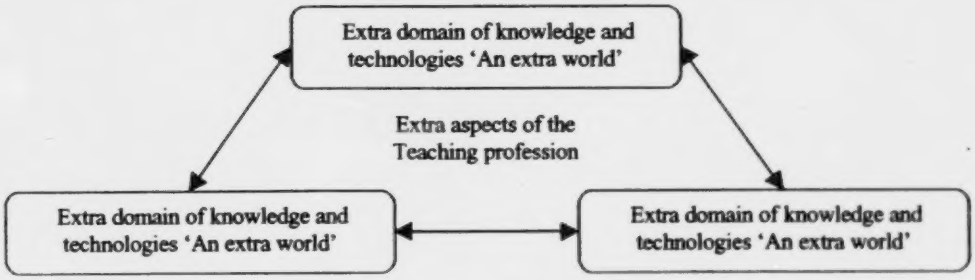
In traditional education, lecturers primarily transferred information. Nowadays students can also use computers to gather, order, analyze and edit information, to report on these activities, to simulate processes, cooperate on assignments, communicate about common interests and to exchange information. Explo uses computers especially as students' tools to make the learning process more productive.

Distance teaching supplementing face-to-face instructions

ICT offers new possibilities for distance teaching. Ichtus Hogeschool uses those possibilities for the foreign program for Dutch enrolled students. For Explo, however, where Ichtus deals with young students, priorities are different: the contacts between students, lecturers and fellow pupils are highly valued. The school building is seen as the social meeting point and as the place for face-to-face instructions. Distance learning does not replace these contacts but supplements them: face-to-face meetings are supplemented with electronic work groups, practical training with multimedia simulations, lecturers' consulting hours with electronic consulting hours, searching for information in the library with the consultation of electronic catalogs, etc.

ICT as a component of the teaching profession

ICT is used in all graduate professions. It completely alters the nature of some professions, such as those of publishers or librarians. But there are also professions that until now have been less in the digital forefront, such as the teaching profession. As a result, the digital "tools of the trade" for the teaching profession have hardly been developed. Most of the possibilities of ICT for teachers in elementary schools, secondary schools and higher education remain to be explored. They include better gearing of the study programs on offer to the learning profiles, learning styles and needs of individual pupils (adaptive education), cooperative learning, and ways of learning that are increasingly designed and implemented by pupils themselves.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Extra aspects of the Teaching profession
Extra domain of knowledge and technologies 'An extra world'
Extra domain of knowledge and technologies 'An extra world'

Figure 1. relevance of ICT for education

The curriculum's three phases

The curriculum is divided into the following three phases:

1. An one-year foundation course, in which students orient themselves to the teaching profession, asking themselves as the most important question: do I want to be and can I be an elementary-school teacher;
2. A main phase (18 months) offering a broadening of the various subjects and themes, the most important question being: what do children have to learn and how do I get them to learn it;
3. A specialization phase, taking another eighteen months, focusing either on the lower grades or the higher grades, the most important question being: what are my educational views and how can I implement them in an elementary school.

Assessments of students' progress take place at the end of each phase.

The curriculum's five strategies

1. Each year of study consists of four terms, each term having its central theme. Themes are based on students' development from freshman to novice teacher. Each theme is elaborated in tasks, cases and projects, introduced by and evaluated with tutors in groups of 12 students.
2. The internship strategy is closely linked with the theme strategy, since internship assignments, too, conducted in pairs, match the theme of the relevant term. One of the implications is that, in a particular term, students take internships in a particular grade of an elementary school.

3. The skills strategy consists of intensive training directed by a subject specialist. Like the internship assignments, these skills are closely linked with the theme strategy.
4. The reflection strategy teaches the student how to react to his or her development, to strengths and weaknesses and to achieving or failing to achieve certain learning objectives. An important aid in this strategy is the multimedia portfolio, in which students collect their plans, products, assessments and responses coherently.
5. The autonomous-learning strategy, though not linked with the theme strategy, *does* have a clear structure. As a result of independent-study programs, each student can set his or her pace in acquiring the required subject knowledge. Especially those students who have already completed subject components in their previous education can complete these subjects at a great rate. It is also possible for students to do in-dept analysis.

Variable class size

Students attend lectures and seminars in groups not larger than 60 persons at the most. In lectures, lecturers or guest lecturers give the required information suitable for large groups; in particular, a lecturer will expound on a term's theme from various angles and will give support regarding the contents of independent-study subjects. In seminars, students give presentations about their projects. The teaching of skills is done in work groups of 24. Introductions to and evaluations of thematic assignments are done in basic groups of 12. Students will perform some assignments in groups of 3 or 4. Internships are taken in pairs, and independent study is done individually.

Incorporation of ICT into the curriculum

The incorporation of ICT into the curriculum is based on six viewpoints:

1. To develop wide-range learning competence, students use ICT during the entire program in carrying out their learning activities with increasing command; these are the process-oriented and learning-process-oriented applications of ICT. They are closely linked with the program's concept (learning to learn-as-you-work);
2. To develop vision and skill in the use of ICT in elementary education, ICT-for-elementary education will feature in each theme-term in a way fitting the theme; these are the profession-oriented applications of ICT;
3. To enhance students' practicing and processing possibilities, multimedia software is used, such as "tutorials", training programs, simulations and hypertexts. These are the new learning aids used along with traditional learning aids such as textbooks;
4. To improve the efficiency and effectiveness of (traditional) teaching and learning methods, these are supplemented with and reformed with the use of ICT, and in some cases even replaced by ICT; these are the instruction-system applications of ICT;
5. To test new possibilities, a range of facilities is available on the Intranet; these are the technical applications of ICT for students and lecturers;
6. To monitor learning and teaching, several electronic systems are available, such as the multimedia portfolio, the study-progress registration system, electronic questionnaires for the evaluation of courses and, of course, computer-supported testing systems.

Thematic setup

As was set out earlier, Explo is a four-year thematic program, each year having four thematic terms. Each theme features ICT-for-elementary education in a manner fitting the theme.

1. The first-year theme is "The challenge of the teaching profession", enabling wide-range orientation to the profession. Students acquire basic skills for elementary education, including basic ICT skills. In principle, no special ICT courses are taught, but students make productions (a multimedia handbook for novice teachers), requiring them to learn how to command the entire range of elementary ICT skills. An ICT core item is included in each of the four theme terms of the first year. Moreover, students in the internship school together with children explore an educational aspect of ICT, on which they give a presentation to lecturers and fellow students during the program.
2. The second-year theme is "The class is the world" and emphasizes the relating of items to each other: playing and learning, emotion and cognition, subject matter and the outside world, inside and outside (primary) school. Thanks to the Internet, the class can bring in the whole world and Explo students in the internship schools will see to that as well. Furthermore, ICT is used in reading and arithmetic lessons, in subjects like art and music and subject integration in elementary schools.

3. The third-year theme is "Aspects of the quality of education" and focuses on adapting the study programs offered to the special needs of children with different talents and backgrounds. It deals with "colorful" education, with increasing the number of study programs on offer, and with the diversity in teaching particular subjects and education theory. In this year, students develop their view of the educational value of ICT in elementary schools.
4. The theme of the fourth year is "Schools are made by people". It emphasizes the development of students' individual professional profiles. In this year they take their trainee-teacher internship and students write their "masterpiece" final papers. The theme depends on the specialty selected by each student. The use of ICT to keep in touch with lecturers and fellow students during the long internship term will undoubtedly be a prominent feature.

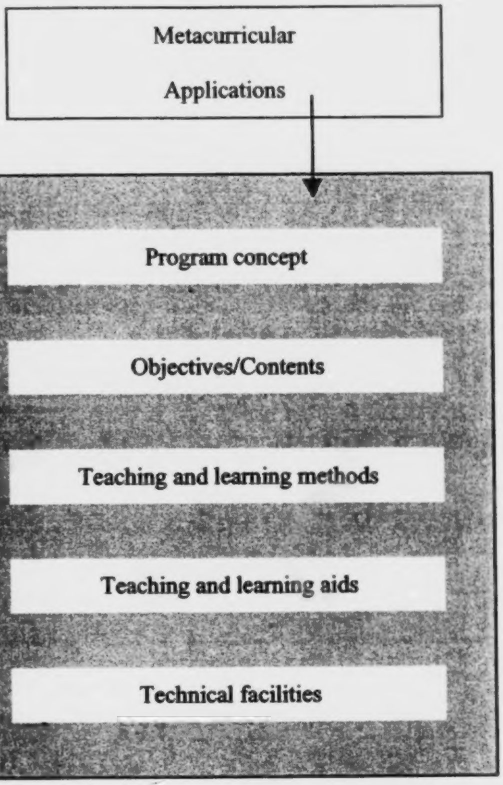

Figure 1. Incorporation of ICT into the curriculum

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THE PRODUCING STUDENT: LEARN-AS-YOU-WORK AND WORK-AS-YOU-LEARN, AN EDUCATIONAL PARADIGM FOR TOMORROW'S SOCIETY

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Abstract: In this poster students and coaches show digital products and the digital work surrounding as used in the new course of the Ichthus University. This poster presents examples of the new education model as described in the paper: "An innovative teacher training course including the integration of ICT; The Explo project of the Ichthus University"

Teachers for tomorrow's society

Explo's objective is to train students as teachers in elementary education who meet the demands of day-to-day educational practice as well as the requirements laid down in the national statutory professional profile. Central issues are the development of independent learning, learning to learn-as-you-work and exploring the role of ICT in education. Besides profession-oriented training, the program's objectives are social and cultural training and further development of students' personalities. The program is not at all free from value judgments. On the contrary, Explo aims to make students experience a school as a community, where people, learning together, are willing to accept responsibility for each other and where sufficient challenge is offered besides due care. But teachers for tomorrow's society need to be equipped with more.

Schools in their social context

The educational point of departure is the social and cultural backgrounds of elementary-school pupils and the school's immediate environment. In the area where Ichthus University is based, this means that both the curriculum and the internship reflect urban problems. The program promotes the students' sensitivity to the social diversity in school classes. Teachers not only transfer culture, but must also be able to criticize the dominant culture. Thus, students are counseled in discovering the values underlying the dominant culture and, consequently, education.

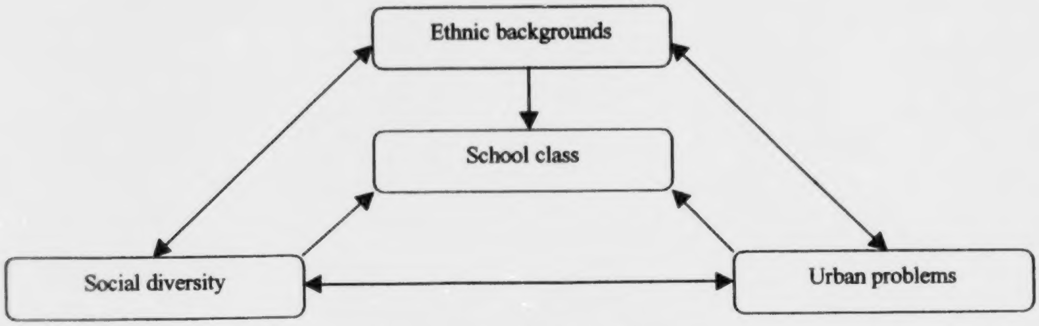

Figure 1. schools in their social context

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Basic attitude toward children and education

An elementary school is primarily a community in which children and grown-ups explore the world together. Paramount in the educator's relationship with the child is the respect for the uniqueness of every human being. For elementary-school teachers it is essential to have ideals from which they want to educate children, share their lives and be their "neighbor". All that is taught in the school will become meaningful only in such a relationship. On the one hand, we expect our students to be guided by this basic educational attitude when they choose to become teachers. On the other hand, the program enables to further develop this basic attitude.

Generalist teachers

Elementary education demands teachers with great employability. Students taking Explo's basic program are thus taught all subject areas and take internships in both the lower and higher grades. Consequently, the basic program provides training in the following competencies:

- General teaching competencies;
- Special competencies, such as public community care (in the context of the re-integration of the disabled into non-special education), teaching in a multi-ethnic context, breaking traditional role patterns, handling norms and values, etc.;
- Competencies in school organization;
- Subject-related competencies to meet the requirements for elementary-school subjects.

After two years and a half, students can choose whether to specialize in the lower grades or the higher grades with regard to these competencies.

Lifelong learning

After completing the program, novice teachers will not have completed their development. The exit qualifications of traditional teacher-training colleges are directed mainly toward the starting-level competencies of elementary-school teachers. "Competency for continued development" is nevertheless of the utmost importance: the ability to adequately respond to new developments both in education and in subject areas. This requires that students learn how to respond critically to present-day education and learn how to learn-as-they-work. This means that they learn from their assignments and their internships, from fellow students, books, websites, lecturers, their social and digital networks, etc. In other words, during the program students learn how to become learning professionals.

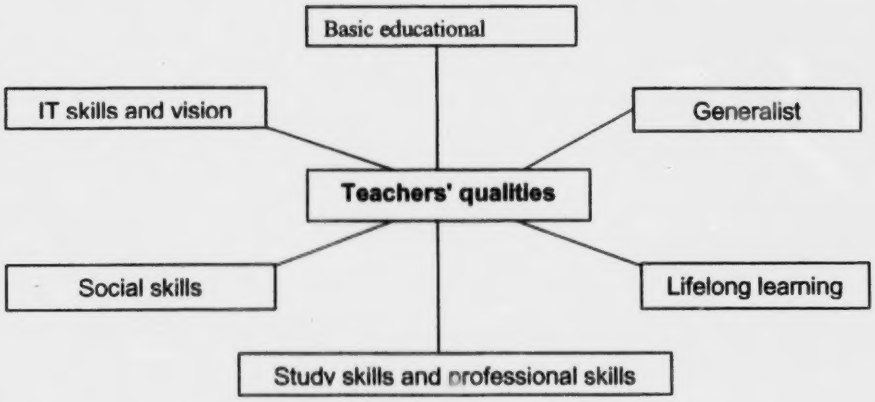

Figure 1. Teachers for tomorrow's society

Study skills and professional skills

In all of the program's components, students work on the acquisition of general study skills and professional skills derived from the professional profile. In Explo we especially emphasize information skills in addition to reasoning skills and methodical action.

Social skills

Since teachers work in teams and must be good communicators in all kinds of consultation settings, Explo teaches students cooperation and communication skills. Students regularly work on assignments in small groups, take internships in pairs, participate in discussion-training courses, etc.

ICT in education: vision and skill

In Explo, the development of views and skills is not an isolated activity, limited to any one subject, component or theme. It is integral to all components of the curriculum. In Explo, we wish to train teachers who:

- Learn-as-they-work and are innovative;
- function in a multi-cultural and international environment;
- and in doing so use ICT with vision and skill.

In Explo, five uses of ICT derive from this mission; ICT serves as:

1. A link between learning-as-you-work in practice and learning-as-you-work during coursework (the Internet);
2. An aid in providing adaptive education in elementary schools in a multicultural and international context (multimedia software, the Internet);
3. A means for students to develop vision and skills in the use of ICT in education: "being digital" (a laptop as a mobile toolbox for daily use);
4. A motor for lecturers and students to be innovative colleagues in designing (digital) learning environments (the Intranet to share knowledge);
5. A hub for the exchange of knowledge (website, electronic discussion platform) and to maintain the organization's external contacts (e-mail).

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Preparing Technology-Proficient Teachers

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Abstract: This study explores the perception of preservice teachers regarding the extent to which their institutions are providing the experiences needed for them to use information technology in their future practice. A major research institution in Southeastern Ohio was selected as the case. Eighteen student teachers within three focus groups--fall, winter, spring--participated in this study. Data collection and analysis were conducted on a continuous basis throughout the 1998-1999 academic year. The study findings indicated that only one course had a primary focus of information technology in the undergraduate curriculum. Preservice teachers experienced somewhat random exposure to information technology in the teaching and learning process in their content and education classes. In field experiences, students viewed only scattered examples of technology use by practicing teachers, and therefore very limited modeling of technology usage. The author recommends increased efforts to integrate information technology into preservice courses and field experiences.

Introduction

The infusion of information technology into the teaching and learning process is challenging to preservice teacher preparation programs. Yet these programs are viewed as the most direct and cost-effective way to prepare the approximately 2 million new teachers who will be teaching in the next decade (National Council for Accreditation of Teacher Education [NCATE], 1997 October).

Although institutions of higher education vary in their specific responses to this challenge, most institutions require at least one educational computing course as a core component of their teacher preparation programs (Leh, 1998). Such courses play a critical role in introducing preservice teachers to fundamental information technology components and skills (Kim and Peterson, 1992). Studies have documented improvement in the amount and quality of coursework in educational computing. However, it is recognized that one required class is inadequate to prepare preservice teachers to use information technology effectively in their future practice (Hunt, 1994; Strudler, 1991; Wetzel, 1993). In addition to educational computing courses, it is recommended that preservice teachers need to observe appropriate models of technology usage in the classroom throughout their university coursework (Huang 1994; Hunt, 1994; Gunn, 1991; Novak and Berger, 1991; O'Bannon, Matthew, and Thomas 1998; Strudler, 1991; Wetzel, 1993). Education faculty need to serve as role models. Their uses of and attitudes towards information technology in the college classroom will strongly influence the implementation of technology by preservice teachers in their future practice. (Barker, Helm, and Taylor, 1995; Huang, 1994; Handler and Marshall, 1992). In addition to the educational computing courses and appropriate modeling throughout the university course work, it is also recommended to integrate information technology into the field component of teacher preparation programs (Gunn, 1991; Novak and Berger, 1991; Strudler, 1991; Wetzel, 1993). As Wetzel and McLean (1997) point out, it is important to place preservice teachers in classrooms where information technology use is modeled appropriately. According to Wetzel and McLean, work in the field is a salient way to help preservice teachers experience deep learning of how to effectively use information technology in their future classrooms.

Today's students live in a global, knowledge-based age, and they need teachers whose practices embrace the best that information technology can bring to learning. Recent federal government estimates suggest that as the number of American students and the demand for smaller student-teacher ratios increase, the education system will be forced to replace nearly 67 percent of its workforce over the next ten years. A large proportion of those new teachers will be recent graduates of colleges of education (National Council for Accreditation of Teacher Education

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[NCATE], 1997 October). This is the time to investigate to what extent teacher preparation institutions are providing the experiences needed by their preservice cadre to use information technology in their future work.

The Study

This study investigates the perceptions of preservice teachers regarding the extent to which their institutions are providing the experiences needed for them to use integrate information technology in their future practice. The specific questions, which guide this study, include the following: (a) What perceptions do preservice teachers have regarding the extent to which educational computing courses are providing the experiences needed for them to use information technology in the teaching and learning process? (b) What perceptions do preservice teachers have regarding the extent to which education faculty are providing the experiences needed for them to use information technology in the teaching and learning process? (c) What perceptions do preservice teachers have regarding the extent to which field experiences with cooperating teachers are providing the experiences needed for them to use information technology in the teaching and learning process?

This study is an exploratory study. In this study, a College of Education at a major research institution in Southeastern Ohio was selected as the case. The study included three focus groups. As Morgan (1998) describes, the focus group is a qualitative research method for collecting qualitative data through group discussions. There are six to eight participants who come from similar backgrounds. Many other variations are possible, however. In this study, all three groups consisted of participants who were student teachers during the 1998-1999 academic year. Only those student teachers in elementary education participated in this study. Group 1(5) consisted of student teachers in the Fall. Group 2 (7) consisted of student teachers in the Winter. Group 3 (6) consisted of student teachers in the Spring.

In this study, a "maximum variation sampling method" (Schumacher and McMillan, 1993) was used to select the study participants. According to Schumacher and McMillan, maximum variation sampling is a strategy for inclusion within a case that seeks to represent a range of differences of perceptions about a topic among information-rich potential participants. For purposes of this study, the range is being able to use information technology in the teaching and learning process among the participants. To select the study participants with a range of information technology experience, the researcher used an "Information Technology Survey," which was developed based on the ISTE Recommended Foundations in Technology for All Teachers (ISTE, 1998 July). The survey was provided to all potential participants (114) during the 1998-1999 school year. Based on the survey results 18 student teachers were invited to focus group interview participating in three groups. Being a student teacher in different schools and teaching in different grade levels were also considered during the selection of participants. Those who participated in this study were student teachers at 11 different schools throughout the Southeastern Ohio, practicing in K-8 classes.

Data collection and analysis were conducted on a continuous basis throughout the year. The research questions drove the analysis. The researcher analyzed the data question by question, looking for themes within questions and then across questions.

Findings

The findings of the study have been organized into three areas for reporting: (a) educational computing course; (b) education faculty use of technology; and (c) cooperating teachers use of technology.

Educational Computing Course

Only one course--EDCI 203, Technology Applications in Education--had a primary focus of information technology in the undergraduate curriculum. All but two participants took the course as required in their program. Most of the participants strongly felt that the course introduced them to fundamental information technology concepts and skills. However, it was limited to address the task of integrating information technology into the teaching and learning process.

Beth illustrated the feeling of many others as she reflected on her experience:

> It was very basic…It pretty much started out with click it twice it's a double click…and really only covered word processing, spreadsheets, database…We viewed some of [educational] software which I think was little bit beneficial just to kind of know what was out there…We did a little bit HyperStudio…[Concerning using it as a teacher in the process of teaching/learning] it made me not be fearful [of technology] as some of the more experienced or older teachers are. Fearful of it. I wasn't fearful to get on the iMac. As soon as it came in I started playing too. But in terms of integrating into the classroom, it didn't teach me how to do that by any means…View the software, create a program, but now how do you implement it at all. I didn't learn any of that.

"My class was the same," said Jane when she reflected on her experience:

> This class kind of got me into it a little more. It was good practice on a computer. The thing that teachers can use like basic Internet functions or electronic mail, spreadsheet, database, we just went through that…Well, like it didn't say if there is one computer in your class how do you teach all the students…That is the thing we need to know.

Stephanie shared the same feeling with her colleagues:

> It didn't go into like how to apply it. You know how I would go about using the computer in the classroom or how I would use the research that I found on the Internet to apply it to a lesson or something like that…I didn't get like any of that.

Carmen pictured the feeling of many others as she reflected on her experience:

> To me, I am still searching how to use, how to integrate…I would like to have strategies how to use three computers in a class of 25. Or like basic troubleshooting stuff. Like if this little problem occurs here what are the things that you can do…I think it would help us if they could break it down into different parts. Like part of it would be practical hands-on. Like here is how you use everything [tools.] And then talk about how you could apply it to the lessons. How you would menage using computers in the classroom.

The need for instructional support addressing the task of implementing information technology in teaching and learning process was an underlying theme. However, the prevalent feeling was that one required technology course was not meeting the needs of preservice teacher to use information technology in their future practice. Most participants were concerned about the conceptual issues covered in the course. They suggested that in addition to teaching certain technology skills, the course should focus on application of those skills in educational settings, and actual classroom management strategies around the idea of having one or few computers with many students.

Education Faculty Use of Technology

The attitude of education faculty towards using information technology in their classroom strongly influences the implementation of technology by preservice teachers in their future practice. However, most participants agreed that they experienced somewhat random exposure to information technology in the teaching and learning process in their content and education classes.

Teresa put it best as she reflected on her experience:

> The only class I got anything out of computers was the 203 [technology class.] All my methods, they didn't integrate computers at all. I think it would have been helpful if they would have.

"None of mine were" said Sara when she described her experience:

> I think that may be in my science methods he may have said or maybe even in a couple of other ones, you now do to the Internet and find lesson plan. Just print it off and bring it in…It wasn't anything about how to incorporate it into subject area. It was just to check and see if we knew how to get on the Internet. Just go to this, print it and bring it in. That's it. So I didn't have anything.

Mike described that

> It's like you are encouraged but you are not really taught what you really need…It was given just like simple ideas like Internet sites for the class.

John described his experience:

> In a couple of my classes I got a list of some good Web sites that I could use. But, my planner had Web sites in it too. I was looking through my planer that other day and I was like oh, Web sites for education.

Bet was concerned experiencing "mixed signal" when she reflected on her experience:

> I had problem with faculty not using e-mail or not even having e-mail account…We were supposed to call them. If they had e-mail it would have been very helpful. Makes you want to use it more, too. If your professor is like oh, no I don't have e-mail, just call me. Then you are like okay. I don't have to. Use technology, but don't have e-mail. Don't even bother me with that; it's kind of mixed signal there. Why should I get it then? It's not that important then I don't need it for my class.

A few participants described that they had different experiences. For example, Adam used his experience to challenge his fellow friends:

> One of the things that I have done in the classroom teaching [student teaching] wise was with the Geometry Sketch program. But I didn't learn that at all in the computer class 203. I learned that in my 330 A & B for my math major. That helped a lot. So I had that and used that a lot in the math [during my student teaching.]

Melissa described her similar experience:

> We used technology in my art class too…We found all the information through the Internet and the library. She [instructor] took us to a class ahead of time to learn how to research, how to e-mail all this kind of things, which was helpful. Then we taught the class. We did some peer teaching with it. We used our lessons that we created. We found the artist and the museum and made a lesson and then we presented it to the class. So it is kind of like you we teaching them and they were learning.

The need for observing technology-using faculty in their curriculum and method courses was a common theme. However, most participants agreed that they have had a few opportunities to observe appropriate models of technology usage in the classroom throughout their university course work.

Cooperating Teachers Use of Technology

Most student teachers found themselves in technology-equipped classrooms/schools during their practicum. However, they strongly felt that they viewed only scattered examples of technology use by practicing teachers. Jen put it best as she reflected on her experience:

> Kids get 10-15 minutes on the corner…and they play some type of game. They are done. It's the next person. So it's never, I have never seen computers incorporated into the curriculum in any way. It's just go do your time, okay your times up and you are off…

Stephanie was agree with Jen when she described her experience:

> …Games…They get on computers on free time and play games and stuff. Basically at the elementary school they use shape games and things like that.

Kelly responded to Stephanie's comment when she explained her experience:

> Stephanie actually nailed it for me when she said free time because that is when they used it. When they had a free time. Free time and as a reward. It was definitely used as a reward…If you can do this then you can go use the computer. As an instructional tool in the classroom, no…I mean we did not use and we had 5 [computers.] They weren't hooked up to the Internet but they were all working and could be printed from if necessary. I tried to set it up as a center. I had 29 kids in the room so it was very difficult to try to get them rotated through the center. We also did used like CD-ROM encyclopedia once for a big ocean project they did. So they researched their ocean animal or their ocean creature. But very rarely.

Leslie described her experience intensively:

> I am just kind of laughing because I am at East [Elementary school] and we have 2 computers in my classroom and I definitely know that my teacher is not comfortable with them because she is always [asking me] can you type up this rubric for me? You seem to be better at it than I am. Like we have these passwords [to access the computer] and she is messing with them. She has broken them three times this quarter already. The kids play games…I have seen them type up a paper once in a great while.

Some participants expressed their concerned about the attitudes of cooperating teachers as well. "I have a barrier," Maria reflected intensively on her experience:

> My cooperating teacher is 69 years old. Computers just really started coming, people really started to know how to use them like maybe when we were seniors in high school or even later…So I think that a lot of teachers in the schools are really uncomfortable using computers because they didn't have a class in college. They are really uncomfortable using them.

I have similar teacher said Susan when she described her experience:

> …She is perfectly fine not knowing, not wanting to know. She is ready to get retired, and she feels that she doesn't need to learn that.

Few participants expressed positive feelings about what they observed in their field experience. Leslie, for example, described her experience differently:

> Actually each neighboring classrooms are joined by a little computer lab in The Plains [Elementary school.] And then each teacher has one [computer.] There is no designated computer time but she does use the computers to supplement her lesson…[For example,] we are going to do graphing today and we are going to do it in your group when they are finished can enter it into the computer or we are going to write poems today and you can make the word problems on the computer to process it. So may be not as much as she should use the computers but she does.

The need for observing technology-using teachers in the field was common theme. However, most participants agreed that they have had a few opportunities to observe appropriate models of technology usage in the classroom where they participated as student teachers.

Reflections and Conclusion

As the United State enters the 21st Century, teacher preparation programs across the nation are assessing their capacity to adequately prepare new teachers to embrace the use of information technology in the education of young people who will live in a global, information-based society. While investigating the status quo, recent studies have produced somewhat disheartening data. Relatively few teachers (20 percent) report feeling prepared enough to integrate technology into classroom instruction (National Center for Educational Statistics, 1999 January). In general, teacher preparation programs do not provide prospective teachers with the kinds of experience necessary to prepare them to use information technology effectively in their future practice (Milken Exchange on Education Technology, 1999). Findings of this study are consistent with the mounting evidence that preservice teachers are not being adequately prepared to teach with information technology. Only one course has a primary focus of information technology in the undergraduate curriculum. Preservice teachers experience somewhat random exposure to information technology in the teaching and learning process in their content and education classes. Furthermore, in field and student teaching experiences, students view only scattered examples of technology use by practicing teachers and therefore very limited modeling of information technology. In order to prepare technology-proficient teachers, teacher education institutions should increase the level of technology integration in their own program. In particular, the author recommends, increased efforts addressing the task of technology implications in educational computing courses as well as integrating information technology into method courses and field experiences.

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Preliminary investigation of some influences on student teachers' self-efficacy for teaching with computers

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Abstract: Although many teachers now have access to computers for teaching and learning and profess a belief in the value of computers for education the impact on the day to day work in classrooms is still limited. Even where teachers believe in the use of computers and have the necessary technical skills they may be reluctant to implement them in their classrooms. Increasing teachers' self-efficacy beliefs for teaching with computers has been proposed as a means of influencing their behaviour. This paper reports on a preliminary study of some factors that might be associated with self-efficacy for teaching with computers. The absence of significant relationships with factors such as Pupil Control Ideology and Innovativeness suggests that it may be possible to intervene to increase graduating teachers' self-efficacy for teaching with computers.

In Australia, as in the USA, computers are now widely available in schools of all types. The arrangements for access vary. Some schools place the computers in classrooms and others create computer laboratories. Whatever the arrangements in their school, there are now very few teachers who could seriously claim that they have no opportunity to use computers in support of teaching and learning.

There is also widespread support for the increased use of computers among policy makers, educational administrators and the community. In Queensland, the government has provided financial support for Schooling 2001, a policy framework which includes as a goal that "computers should be used in every subject area at every level of education" (Education Queensland 1998).

Despite the levels of opportunity and official encouragement implied by these developments, there continue to be concerns expressed about both the frequency and success with which teachers employ information technology in their classrooms (Cuban 1998). Recent online discussions among students returning from teaching practice have included comments about the limited use being made of computers in many classrooms. However, students observed that even teachers who did not use computers in their teaching expressed belief in the importance of computers in education. Surprisingly, on some accounts the rate of uptake of information technology in classrooms does not appear to be notably higher among beginning teachers than among their more experienced colleagues (Oliver 1993).

Various reasons have been postulated to explain the apparent reluctance of teachers to embrace IT. On the whole teachers appear to share the broader community enthusiasm for IT in education as a "good thing" but they report a lack of confidence in their capacity to use IT effectively for teaching and in many cases attribute this to inadequate preparation (Albion 1996; Handler 1993).

A previous paper (Albion 1999) discussed the importance of teacher beliefs in relation to their adoption of IT for teaching. Self-efficacy for teaching with computers (SETWC) was suggested as an area of belief which was related to teacher behaviour in the longer term, was measurable using existing scales and was capable of being influenced by teacher educators in the context of preservice and inservice courses. Problem-based learning (PBL) has been identified as an instructional design methodology that might offer particular advantages in relation to development of self-efficacy (Albion & Gibson 1998) and a multimedia package using this methodology has been developed (Gibson & Albion 1999).

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Factors Influencing Self-efficacy for Teaching with Computers

If self-efficacy for teaching with computers is a significant determinant of teachers' behaviour in respect of teaching with computers and if PBL is an effective instructional design for influencing self-efficacy, then multimedia using PBL as a basis for design warrants investigation as a means of increasing beginning teachers' SETWC. As part of the development of the multimedia package it was proposed to test this hypothesis by measuring students' SETWC before and after the use of the materials.

The Microcomputer Utilization in Teaching Efficacy Beliefs Instrument (MUTEBI) was selected as a measure of SETWC. MUTEBI was initially developed and used in the context of science teaching (Enochs et al. 1993) but it is not specific to that context. It comprises two sub-scales which correspond to the two components of the self-efficacy construct identified by Bandura (1977), namely efficacy expectations, which was labeled by Enochs as self-efficacy (SE), and outcome expectations, labeled as outcome expectancy (OE).

Teachers' beliefs and behaviours in respect of computers do not stand in isolation from their other beliefs. Previous studies have demonstrated that teachers' use of computers may be influenced by, among other things, their beliefs about student centred pedagogy (Honey & Moeller 1990) and their inclinations towards innovativeness (Marcinkiewicz 1994). Moreover, students who reported more custodial orientations on the pupil control ideology (PCI) scale also reported lower self-efficacy for science teaching (Enochs et al. 1995). It is often suggested that the use of computers in teaching leads to more student-centred approaches to teaching. Thus, the possibility of a relationship between PCI and SETWC should be considered.

The effectiveness of the multimedia package in increasing students' SETWC may depend, at least in part, on the existence and relative strength of these other influences on SETWC. Early knowledge of such factors might guide refinement of the materials design. Hence an investigation of the relationships between SETWC and other aspects of student teachers' belief systems is warranted.

Because the multimedia materials were to be developed using an untried design, plans were made to conduct trials of a very early prototype with a small group of students who were representative of those who would use the final product. This group provided a suitable opportunity to trial the instrument that would be used to measure SETWC and to undertake a preliminary investigation of potentially influential factors.

It seems reasonable to assume that positive attitudes towards computers and strong self-efficacy for computer use would be prior conditions for positive self-efficacy for teaching with computers. Scales for the measurement of attitudes towards computers and self-efficacy for computer use have been developed and used with teacher education students (Kinzie et al. 1994). The attitude scale has two sub-scales that relate to comfort/anxiety and usefulness of computers. The self-efficacy scale comprises several sub-scales that relate to categories of computer use including word processing, spreadsheets, databases and so on. Subsequent studies have confirmed the reliability of the attitude scales and of a slightly modified version of the self-efficacy scale comprising seven sub-scales (Albion in press). The scales described in the latter paper were used in this study.

Scales for the measurement of teacher self-efficacy have been developed and used in several published studies. For the purposes of this study the instrument described by Guskey and Passaro (1994) was selected because it was the most recently published validated scale for teacher self-efficacy. It comprises two sub-scales. The internal sub-scale appears to represent perceptions of personal influence in teaching and learning while the external sub-scale represents the influence of elements beyond the direct control of the teacher.

Two other factors were chosen for examination. Pupil control ideology (Graham et al. 1985) is a unidimensional construct which has been found to be related to self-efficacy for science teaching (Enochs et al. 1995). As noted above, PCI could influence SETWC through the relationship between custodial orientation and student-centred classes. It was measured using the instrument published by Graham (1985). Innovativeness has been found to be related to computer use in teaching (Marcinkiewicz 1994). It was measured using the unidimensional instrument published by Hurt et al. (1977).

All instruments used in this study were derived from previously published studies. The body of the questionnaire comprised 134 items representing 15 scales and sub-scales as shown in Table 1. Each item was presented as a

Likert scale item with the extremes of the range identified as Strongly Disagree on the left and Strongly Agree on the right. The number of points on the range for each scale varied from 4 to 7 according to the usage reported by the originators of the scales. Table 2 records the maximum value attainable on each scale.

Results

A total of 31 students (25 females and 6 males) who were completing the final year of their Bachelor of Education degree completed the questionnaire. Ages ranged from 20 to 28 years (mean = 21.7, standard deviation = 1.8) with strong clustering around 21 years implying that most respondents had entered the degree program directly from secondary school. As an indication of relative familiarity with computers, respondents were asked to select a category which represented the number of hours they spent working with a computer in a typical week. These data are summarized in Figure 1.

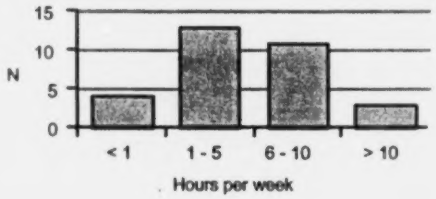

Figure 1: Distribution of computer use in a typical week

The small sample size precluded reliable factor analysis of the scales and they were assumed to exhibit the characteristics described in the published sources. Reliability values were computed and are shown in Table 1.

Instrument & Source(s)	Sub-scale(s)	Items	Alpha
Attitudes towards Computer Technologies (ACT) (Kinzie et al. 1994)			
	Comfort/Anxiety	8	.85
	Usefulness	11	.54
Self-efficacy for Computer Technologies (SCT) (Albion in press; Kinzie et al. 1994)		53	.97
Pupil Control Ideology (PCI) (Graham et al. 1985)		10	.62
Microcomputer Utilization in Teaching Efficacy Beliefs (Enochs et al. 1993)			
	Outcome efficacy	7	.77
	Self efficacy	14	.85
Teacher Efficacy Scale (Guskey & Passaro 1994)			
	External	11	.81
	Internal	10	.82
Innovativeness (Hurt et al. 1977)		10	.71

Table 1: Instruments & sources, sub-scales, number of items, and reliability measures

For each scale, student scores were computed as the mean of the item scores for each student in order to facilitate comparisons. Table 2 shows the means and standard deviations of the results obtained for each scale together with the maximum score possible on the scale as determined by the number of points on the Likert scale.

Instrument	Sub-scale	Scale maximum	Mean	SD
ACT				
	Comfort/Anxiety	4	2.79	.54
	Usefulness	4	3.42	.30
SCT				
	E-mail	4	2.31	1.12
	Internet	4	2.29	1.02
	Word processing	4	3.64	.45
	Operating system	4	3.08	.67
	Spreadsheet	4	3.09	.71
	Database	4	2.96	.79
	CD-ROM	4	2.62	.80
	SCT composite	4	2.90	.61
PCI		5	2.48	.43
MUTEBI				
	Outcome expectancy (OE)	5	3.61	.56
	Self efficacy (SE)	5	3.24	.57
Teacher Efficacy				
	External	6	2.71	.65
	Internal	6	4.37	.58
Innovativeness		7	5.02	.64

Table 2: Mean and SD of scores (N = 31)

Scores obtained for the ACT and SCT instruments were compared with the posttest scores reported for a group of first year students in the same program (Albion in press). The only significant differences were for Usefulness (t = 3.11, df = 117, p = .002) and word processing (t = 2.45, df = 115, p = .016). In each case the final year students returned higher scores indicating stronger belief in the future usefulness of computers and greater confidence in their ability to use a word processor.

Pearson product moment correlation coefficients were computed for pairs of measures. As described previously (Albion in press), scores on the sub-scales of the SCT were combined to form a composite measure of self-efficacy for computer use. Results are shown in Table 3.

	Age	Comf.	Usef.	SCT	PCI	OE	SE	Ext.	Int.
Comfort	.21								
Usefulness	.26	.52**							
SCT	-.13	.59**	.36*						
PCI	-.35	-.03	-.28	-.10					
OE	.03	.56**	.54**	.49**	.06				
SE	-.05	.50**	.33	.75***	-.07	.44*			
External	-.09	-.18	-.21	-.29	.38*	-.20	-.41*		
Internal	-.01	.01	.15	.21	-.28	.31	-.01	-.22	
Innovativeness	.53**	.42*	.30	.10	-.30	.20	.00	-.04	.27

* p < .05   ** p < .01   *** p < .001 (2-tailed)

Table 3: Correlation coefficients for pairs of scales (N = 31)

Discussion

The most significant correlation found was between the SE sub-scale of SETWC and SCT, implying that student teachers who report strong belief in their personal capacity to work with computers are more likely to report feelings of self-efficacy for teaching with computers. SE is also very significantly correlated with the comfort/anxiety sub-scale of the ACT, confirming that students who are comfortable with computers feel more positive about their ability to teach with them.

Outcome expectancy (OE) on the SETWC instrument corresponds to student teachers' beliefs that, through good teaching, they could increase the computer competence of pupils in their class. OE is significantly correlated with both sub-scales (comfort/anxiety and usefulness) of the ACT and with the composite SCT score. The implication is that graduates who have strongly positive attitudes towards computers and confidence in their ability to use them are more likely to believe that they can transmit those qualities to their pupils.

A significant correlation was found between age and innovativeness. The implication of this is not clear but it may result from older students (maximum age in this sample was 28) being more confident of their personal priorities and being prepared, at least in theory, to consider variations to common practice.

The remaining highly significant correlations are between the two sub-scales of the ACT and between the comfort/anxiety sub-scale of the ACT and the SCT. These relationships have been reported previously (Albion in press). It is hardly surprising that beliefs in the usefulness of computers, which would probably influence patterns of use, should be correlated with feelings of comfort with the technology. It is equally understandable that comfort with computers should be related to confidence in their use as measured by the SCT.

Contrary to expectations based on the results reported previously (Enochs et al. 1995; Marcinkiewicz 1994), neither innovativeness and pupil control ideology was significantly correlated with either sub-scale of the MUTEBI. A significant correlation was found between innovativeness and the comfort/anxiety sub-scale of the ACT. This might be explained in terms of comfort with new technologies being indicative of preparedness to adopt new approaches. The significant correlation between PCI and the external sub-scale of the Teacher Self-Efficacy instrument may indicate an association between a custodial orientation towards classroom management and a belief in the power of influences beyond the direct control of the teacher.

The implications of these findings for attempts to influence student teachers' self-efficacy for teaching with computers through their interaction with a multimedia package remain to be tested in practice.

The factors most strongly correlated with SETWC are comfort with computers and self-efficacy for computer use. These are among the factors that might be influenced by students' working with a multimedia package that presents examples of effective use of technology in teaching together with opportunities to rehearse relevant patterns of thought.

Factors such as innovativeness and pupil control ideology seem inherently more likely to reflect stable characteristics of students' personalities. If self-efficacy for teaching with computers were strongly related to these factors it might prove more difficult to obtain significant increases through the short term use of a teaching intervention such as a multimedia package. The implication appears to be that the use of the multimedia materials may produce the desired increases in self-efficacy for teaching with computers.

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Preservice Teachers' Beliefs about Effective Uses of Computers in the Classroom: A Content Analysis of Narratives

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Abstract: In this paper, the results of a content analysis are presented of preservice teachers' narratives describing how they would use computers in a classroom to bring about learning. This study is a continuation of an examination of preservice teachers' preconceptions about the role of the computer in the classroom. Each of the 286 narratives was reviewed and categorized by three instructional technology experts. The results indicate that prior to formal instruction, preservice teachers possess naïve conceptions about effective roles of the computer to support learning.

Introduction

The demand for teachers who can effectively use technology to create meaningful learning environments for students is increasing (U.S. Department of Education, 1999). This fact, coupled with the predicted rate of teacher turnover (Darling-Hammond, 1996), makes the preparation of technology-using teachers among the highest priority for schools of education. Unfortunately, few teacher education institutions adequately prepare teachers to use technology (Quinn & Strudler, 1999; Willis & Mehlinger, 1996; Wetzel & Strudler, 1999).

Effectively preparing teachers who can integrate technology and pedagogy is a complex, arduous task. In part, because preservice teachers often enter instructional technology courses with personal theories about the role of computers in teaching and learning. These theories have evolved from their 12 years of experience as students. When studying about teaching, preservice teachers often use their personal K-12 experiences to understand instructional methods. This perpetuates a cycle in which students who were taught using didactic methods draw on these experiences and personal theories when solving problems in their teacher preparation courses (Niederhauser, Salem, & Fields, 1999; Sadera, 1997).

Preservice teachers' preconceptions can be inaccurate, incomplete, resistant to change, and affect student learning (Posner, Strike, Hewson, & Gertzog, 1982). In addition, if a student's existing theories are strongly held beliefs, the student may reject

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conflicting ideas presented via traditional instruction and retain their personal theories (Posner et al., 1982). If preservice teachers are to espouse more comprehensive conceptions about classroom computer use, they will need to engage in conceptual change.

The conceptual change theory describes a process whereby rational beings may alter or abandon existing conceptions for ones that are widely supported by empirical evidence (Posner et al, 1982). Conceptual change occurs in four stages through which individuals need to progress to change their conceptions; they are dissatisfaction, intelligibility, plausibility, and fruitfulness.

Although many researchers have examined preservice teachers' perceptions of computers, few have examined preservice teachers' conceptions and conceptual development about educational computing. At the crux of this research study is the Thomas and Boysen Taxonomy for Instructional Computer Use (1984). This taxonomy categorizes classroom computer use based on the student's experience with the subject matter being taught. The taxonomy consists of five categories: experiencing, informing, reinforcing, integrating, and utilizing (Figure 1). Previous research on preservice teachers' technology preconceptions has shown that preservice teachers tend to possess simplistic views about classroom computer use (Sadera & Hargrave, 1999).

By analyzing the content of participants' narratives, this study describes how preservice teachers believe computers should be used in a classroom to bring about effective learning. This study is a continuation of an examination of preservice teachers' preconceptions about the role of the computer in the classroom (see Sadera & Hargrave, 1999).

Category*	Definition
Experiencing -	student has little knowledge of subject matter; computer is used prior to formal instruction to set stage and serve as catalyst for future learning. Description explicitly states that student uses computer prior to formal instruction
inForming -	student is prepared to receive formal instruction on subject matter; computer is used by learner to acquire information. Description explicitly states that the computer is being used to teach or deliver instruction.
Reinforcing -	student has initial understanding of subject matter; computer helps learner to strengthen knowledge previously acquired. Description explicitly states that student uses computer after formal instruction
inTegrating -	student is linking previously unrelated ideas to form new knowledge; computer is used to link classroom knowledge with real world situations to solve problems.
Utilizing -	computer serves as a tool to eliminate menial tasks allowing the student to concentrate on the subject matter.

*Categories are based on the cognitive state of the student with respect to subject matter (Thomas and Boysen, 1984)

Figure 1: Thomas and Boysen Taxonomy of Instructional Computer Use

Research Questions

The purpose of this study was to extend our understanding of preservice teachers' preconceptions about the role of the computer in the classroom. Three research questions guided this investigation.

Research Question 1: What categories of Thomas and Boysen Taxonomy are the narratives most consistent with?

Research Question 2: How do preservice teachers describe effective uses of computers to bring about classroom learning?

Research Question 3: What do the data suggest about preservice teachers' preconceptions about the role of the computer in the classroom?

Methods

Procedures To obtain data regarding preservice teachers' preconceptions about effective uses of computers to bring about learning, the study activities were integrated into an introductory instructional technology course. During the first two weeks of the semester, approximately 300 preservice teachers at a large Midwestern university, were asked to write a narrative in response to the following open-ended statement: "Describe how you would use the computer in the your field of study to bring about effective classroom learning". Part of a larger study (see Sadera, 1997), the responses to this question were gathered in the hands-on laboratory sections of the course.

Data Analysis To analyze the students' narratives, a content analysis procedure was used. The purposes of the content analysis were to categorize the narratives according to the Thomas and Boysen Taxonomy of Instructional Computer Use (1984) and to characterize the content of the narratives. To complete this analysis, experts in instructional technology reviewed and rated the narratives.

Ten experts in instructional technology participated in the content analysis. The experts received training on the analysis procedures prior to reviewing the narratives. Using the definitions provided by the researchers, the ten experts were to carefully review the narratives and determine the category of the Thomas and Boysen Taxonomy with which each narrative was most consistent. Each narrative was reviewed and rated by three different experts. Using an eight-point scale (Figure 2), each expert reviewed and rated approximately 90 narratives; for the 286 narratives, the inter-rater reliability = .77.

BACL Rater's Quick Check Sheet

Original item given to respondents:

Beliefs about effective computer use for learning assignment

Select a discipline (i.e., math, science, English) and describe an example of how you would incorporate the computer into a lesson.

Rating Scale

E = experiencing
F = informing
R = reinforcing
T = integrating
U = utilizing

DA = doesn't address the question
0 = blank or no answer
9 = multiple examples of computer use within one answer (not multiple categories)

Figure 2: Narrative Rating Scale used by Instructional Technology Experts

Results

Two hundred eighty six students completed narratives for the study. Of 286 narratives, 32 were eliminated because the study participants didn't complete all parts of the original study. The narratives from 28 participants were eliminated because their responses did not address the question; and 26 narratives were removed from the sample because there was no consensus among the experts in the ratings. The number of narratives used in the following analyses was 200.

Research Question 1: What categories of Thomas and Boysen Taxonomy are the narratives most consistent with?

The data analysis indicated that informing and reinforcing were the two most commonly described uses of the computer for effective classroom learning (Table 1). Nearly 60% of the narratives consisted of examples of using the computer to deliver information to students or reinforce previously taught material. Although using the computer after formal instruction was a common example in the narratives, using the computer before formal instruction to set the stage for learning was not. Only one narrative described using the computer to help students develop an understanding of the materials prior to formal instruction.

Nearly 20% of the respondents indicated that having students use the computer to manipulate the subject matter (e.g. write papers, form budgets, access information) would bring about effective classroom learning. Twenty-one percent of the narratives described multiple uses of the computer in the classroom. (The narratives rated as multiple uses of the computer are not analyzed in this paper.)

Table 1: Ratings of narratives by Thomas and Boysen Taxonomy

Category	N	Valid Percent
Experiencing	1	5
Informing	62	31
Reinforcing	53	26.5
Integrating	3	15
Utilizing	39	19.5
Multiple categories	42	21

Research Question 2: How do preservice teachers describe effective uses of computers to bring about classroom learning?

To move beyond the mere categorization of the narratives, the researchers also studied the documents to ascertain their character. The descriptions of effective classroom computer use provided by the participants are consistent with the uses of computers they experienced as students in K-12 classrooms (Sadera, 1997). These narratives provide a great deal of insight into their preconceptions. Below are narratives written by the study participants. Using simple random sampling procedures, the researchers selected five percent of the narratives as examples to demonstrate the preservice teachers' preconceptions.

Overall, these narratives exhibit rudimentary conceptions of educational computing; furthermore, they tend to be Type I (i.e. using the computer to teach in traditional ways (Maddux, 1984)) uses of computers in the classroom.

In a science lesson, a computer could be quite helpful. I would begin by giving background of the topic (i.e. earthquakes). Then the computer could be used to show earthquakes in a more 3-D way instead of looking at it from a book.

In a math class, I would first teach how to do addition using the chalkboard... Then a couple days later, I would give the students a chance to play a computer game involving addition. This makes learning fun and I think they get more out of it!

English – computers can be used to practice and reinforce what the teacher taught about such things as parts of speech. Students can use computers to publish creative writing stories including graphics.

Math has always been a hard subject for me in high school. I remember in middle school we would always use the computer lab to help us with our math and to introduce us to new things. This always helped me because I am a visual learner and I have to see it being done in front of me at my pace. If I needed to see it being done again, all I would have to do is click a button and I could see it again. This helped me out in a lot of ways and made it seem more like a game than just doing math problems.

To do a math lesson on probability, I might use Power Point. This would help all the students see and figure out the probability of dice being rolled at random. Sometimes seeing things makes it easier to comprehend.

Spanish – perhaps do a matching activity with vocabulary and pictures which keeps a print total for correct answers and rewards the child in the end. Certain games could be used to facilitate the lesson or review for a test.

Science (Anatomy) – You could get a software program that is geared toward scientific learning, and have students explore its features, and have them follow it along with a book.

English writing paper. The kids learn keyboarding skills along with being able to spell. Also they learn and develop skills for good writing

In the history class I plan to teach, I would incorporate the computer by using websites. In history the more resources you have, the easier it is to gain an overall view of a topic. So I would encourage and demand that my students get information for assignments not only from periodicals but from websites as well.

I might create a lesson in English on finding books on the net. I don't think computers should be used much to teach a lesson. Too many teachers are taking out the personal aspects of the classroom and turning it into a technology-based center of learning. I think it is important to know how to use a computer, but that is where computer classes come in. Don't over use them — it's the easy way out.

Research Question 3: What do the data suggest about preservice teachers' preconceptions about the role of the computer in the classroom?

The content analysis of the preservice teachers' narratives indicates that preservice teachers possess naïve conceptions of computer use for effective classroom learning. Fifty-eight percent of the narratives described simplistic uses of the computer (as defined by Hooper & Thomas, 1990). That is, the preservice teachers view the computer as a device to supplement traditional teaching methods. Several of the examples included above describe using the computer to complete tasks that are possible without the computer (e.g. practicing addition skills, sustain vocabulary skills, reinforce basic writing techniques, etc.). In addition, several of the examples described using the computer as a device to teach with (i.e. a presentation device).

Twenty percent of the narratives described using the computer as a tool to manipulate subject matter. For example, several participants depicted writing papers, finding resources, and developing spreadsheets as appropriate ways to use the computer to bring about effective classroom learning.

The researchers were surprised at the number of preservice teachers who described advanced ways of using the computer to support learning. To better understand this result, the researchers compared the data of these 39 preservice teachers with the data from the larger study. Specifically, we examined the following variables: experience with computers in education, attitudes towards computers, computer proficiency, and beliefs about knowledge acquisition. No significant differences were found between the two groups.

Conclusions

The intent of this study was to better understand preservice teachers' preconceptions about the role of the computer in teaching and learning. The content analysis procedure was an effective method to characterize the participants' conceptions.

The results of this study are consistent with the larger study of which this reseach was a part (see Sadera & Hargrave, 1999). Preservice teachers possess naïve conceptions of how the computer can be used to bring about effective classroom learning. Their conceptions are consistent with didactic, objectivist views of teaching and learning and support traditional teaching methods.

Clearly there is an increasing need for teachers who can effectively integrate computer-technology to create meaningful learning environments. Given the results of this study, teacher educators need to devise instructional strategies that will assist preservice teachers in developing more comprehensive views of teaching, learning, and the role technology can play in the classroom.

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Flexible Delivery of Teacher Professional Development for Information Technology in Learning

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Abstract: This paper compares the experiences of undergraduate education students on two university campuses who experienced an introductory information technology subject using different methods of flexible delivery. The paper analyses differences in the perceptions of the students on the two campuses as evidenced by a subject evaluation survey administered in the final week of the subject. Students at this level, express greatest satisfaction with subject delivery when it incorporates adequate human and technological support accompanied by online resource material.

Introduction

Subject delivery is key to student engagement with the subject content. It impacts not only on what students learn but also on their attitudes and beliefs about the subject area. In response to community, commercial, employer and parental pressure, teachers are being required to implement teaching practices that incorporate information technologies. The attitudes and beliefs that teachers have about using information technologies to enhance learning will be influenced by their experiences in their pre-service education degree study. This paper compares the experiences of undergraduate education students on two Australian university campuses who experienced an introductory Information Technology (IT) subject using different methods of flexible learning.

'Flexible learning' is one of those terms that everyone uses but nobody agrees on its exact meaning. For example, Louise Moran (1996) contends that "Flexible learning is multi-dimensional and does not lend itself to a neat, one-line description" while Rachel Hudson et al. (1997) suggest that "There is a confusion in the minds of practitioners between the terms open, distance, flexible and resource-based learning" (p.2). However Peter Taylor and Gordon Joughin (1997) are clear that flexible learning "prioritises learner control over the requirements of institutional practices". They claim that flexible learning "focuses the design of courses and subjects on *how* students will engage in learning activities … and *how* their participation and learning will be supported" (p.2, emphases in original).

Flexible learning in higher education has been a response to a number of factors. Hudson et al. (1997) include the following: pedagogy, cuts in funding, increasing diversity of students, equal opportunities, labour market requirements, and the demand for transferable skills. But most importantly in these factors have been IT improvements making available a range of delivery genre (including traditional print materials, video, audio tapes, Compact Disc based multimedia, and Internet delivery), and the huge increase in home ownership of computers and access to the Internet.

In the University in which this study was carried out, considerable resources were made available to allow all subjects on a new campus to include Internet delivery and it was strongly suggested (but not mandated) that subject convenors avail themselves of this option. Inclusion of Internet delivery for at least some aspects of the course was further encouraged by the ready availability of high-end computers for student use. This made possible the cross campus comparison of student's perceptions within the same subject that is the focus of this study.

While there is a fairly large literature on flexible learning and what it entails (see for example McGinnity et al., 1999 and Niklova & Collis, 1998) there has been less discussion on evaluating programs and subjects that employ flexible delivery methods, particularly where on-line (Internet) genres are used. This is probably because flexible learning using on-line facilities is still in its infancy. Diana Laurillard et al. (1997) suggest that "While perhaps the most judicious reason for evaluating an educational program is

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to improve it", there are a number of other reasons for evaluating that might include informing interested parties, encouraging others to adopt similar methods, throwing light on innovative programs, and determining effectiveness. To these I would add determining student satisfaction. Students are becoming increasingly informed consumers of university courses and competition for students between universities is fierce. Therefore we should not be embarrassed to admit that one of our primary goals in educational evaluation is to determine student satisfaction and find ways of enhancing it – along with our usual pedagogical goals of course.

About the Subject

The evaluation that this paper is based on was concerned with the subject *Learning with Information Technology*. This is a first semester, first year subject in an initial teacher education program. The subject is designed to introduce students to aspects of IT relevant to teaching and learning. The subject was conceptualised in three parts – Concepts and Ideas, Applications, and Developing Assignments. The students were supplied with detailed *Subject Profiles* that explained the rationale, concepts, delivery, timetable, requirements and assessment items for the subject. The subject was taken by 350 students at Griffith University, Australia, comprising a cohort of 81 students on the Logan campus and 270 students on the MtGravatt campus. Logan campus is a new campus that specialises in flexible delivery. MtGravatt campus is a traditional campus that has its origins as a College of Advanced Education. On the MtGravatt campus the Concepts and Ideas aspect of the subject was delivered via one-hour lectures in a lecture theatre. In addition a one-hour tutorial in a computer laboratory addressed the Applications and Developing Assignments aspects of the subject. All aspects of the subject were supported with online material. On the Logan campus the students had the same online material available to them plus a two-hour workshop in a computer laboratory but no lecture. The workshop dealt with Applications and Developing Assignments. The Logan students had a *Book of Readings* available for purchase through the campus bookshop. The Concepts and Ideas section of the subject was studied independently by the students using the online material and the *Book of Readings*.

The student populations on both campuses were essentially the same with 86.30% of the Logan population and 90.91% of the MtGravatt population being female. This is in keeping with the highly feminised (and increasingly so) nature of the teaching profession in Australia. 58.44% of Logan students and 57.99% of MtGravatt students are under 21 years of age but there is a significant component of older students in both populations with 22.08% of Logan students and 19.18% of MtGravatt students being 30 years of age or older. The biggest difference between the two populations was in the number of immediate family (parents, siblings, children) who had attended university (see Figure 1). At Logan 70.13% of students had no immediate member of the family who had attended university compared with 46.12% of MtGravatt students.

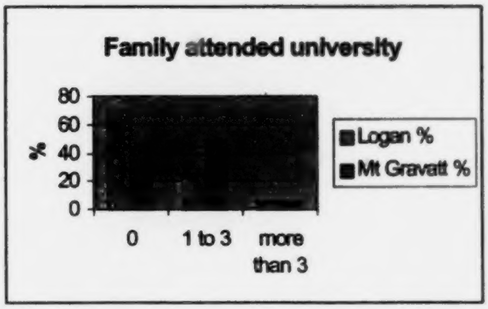

Figure 1: Number of immediate family who had attended university.

The Survey and Results

The perceptions of the students on the two campuses were ascertained from a subject evaluation survey administered in the final week of the subject. The survey consisted of questions concerned with the subject in general, the format of the subject, and about them as students, as well as a rating for the subject and the tutor and open ended questions concerning the strengths and weaknesses of the subject. The surveys administered on the two campuses were essentially similar with minor modifications to allow for the differences in subject delivery on the two campuses.

Subject Satisfaction

The students were asked to rate the subject from 1 (Low) to 7 (High). A result of 7 would indicate that all students rated the subject High. Table 1 shows the differences in the student satisfaction with the subject on the different campuses. At the Logan campus the subject was rated at 4.70 and at the MtGravatt campus the subject was rated at 3.84. It is clear from this result that the Logan students rated the subject more highly than the MtGravatt students yet the content and assessment of the subject on both campuses were identical. The only difference between the campuses was in delivery.

Question (1 Low – 7 High)	**Result**	
	Logan	**MtGravatt**
How would you rate this subject?	4.70	3.84

Table 1: Difference in subject satisfaction between campuses

General Statements about the Subject

On the survey there were four statements about the subject in general. The students were asked to enter a number against each statement from a rank of 1 to 7, where 1 represented 'strongly disagree' and 7 represented 'strongly agree'. Therefore a result of '7' to a question would indicate that all students strongly agreed with the given statement. The comparative results between campuses for general perceptions about the subject are shown in Table 2.

Statement (1 Strongly disagree – 7 Strongly agree)	**Result**		**Difference (Logan – MtGravatt)**
	Logan	**MtGravatt**	
This subject is of direct relevance to my professional life as a teacher	5.14	5.12	0.02
The level of the subject was appropriate to my background	3.46	3.73	-0.27
This subject provided a context in which I gained competencies for teaching	4.58	4.05	0.53
The assessment in this subject was an important part of the total learning experiences in this subject	4.73	4.30	0.43

Table 2: Comparative results between campuses for general perceptions about the subject

The first statement was intended to gauge the students' belief in the relevance of a subject about learning with IT to their professional life as a teacher. The results (5.14 at Logan and 5.12 at MtGravatt) show that the students have a clear understanding that the subject *Learning with Information Technology* was relevant to them as future teaching professionals. There was little difference (0.02) between the two campuses. The second statement on the appropriateness of the subject to the students' backgrounds was less positive and the Logan students rated this statement negatively (3.5 being the mid-point). There was also greater difference (0.27) between the campuses. As the students did essentially the same work on both campuses this seems to suggest that the students on the Logan campus came into the subject less well prepared with respect to IT skills. This was borne out in the data collected from a survey conducted with these students at the beginning of the semester where they were required to rate their competencies with a range of applications (email, word processing, Web searching, presentation software, spread sheets, databases, desk top publishing, multimedia development and Web page development). In all applications (except for word processing which they rated equally) the Logan students rated their competency lower than the MtGravatt students. With respect to the third statement concerned with gaining competencies for teaching within the context of the subject, there was strong support (4.58 at Logan and 4.05 at MtGravatt) with a difference between the campuses of 0.53. When read in conjunction with the previous statement these figures suggest that Logan students were more positive about this statement because they learnt more, possible because they knew less to start with, or because the learning experience was more conducive on the Logan campus.

Statements about Subject Delivery

The format of the statements about subject delivery was the same as for the general questions, that is a score of '7' would indicate that all students 'strongly agreed' with that statement. Because of the differences between the delivery methods on the two campuses there were variations in some statements between campuses. The results are shown in Table 3.

Campus	**Statement** (1 Strongly disagree – 7 Strongly agree)	**Result**
Logan	The online Concepts and Ideas material provided me with stimulating ideas and foundation theories about learning with information technology	4.19
MtGravatt	The lectures provided me with stimulating ideas and foundation theories about learning with information technology	2.82
Logan	The structure of the online Concepts and Ideas material was easy to follow	4.30
MtGravatt	I found the online concepts and Ideas material useful	4.26
Logan	I would prefer to attend face to face lectures rather than have this material presented in online material	4.30
MtGravatt	I prefer to use the online material than attend lectures	5.31
Logan	I would prefer to have both face to face lectures and online material	5.02

Table 3: Results for statements about subject delivery.

One of the major differences between the delivery on the two campuses was in the presentation of lectures concerned with the Concepts and Ideas of the subject on MtGravatt campus while on Logan the students studied this aspect of the course independently using the online material and a *Book of Readings*. It can be seen that the Logan students expressed greater satisfaction (4.19) than the MtGravatt students (2.82) but they also expressed a preference for attending lectures rather than having the online material (4.30) and for having both lectures and online material (5.02). In contrast the MtGravatt students expressed a preference for online materials rather than lectures (5.31) and in fact when they found that the lecture material was available online a large number simply did not attend the lectures.

Statements about Computing Competencies

The statements that related to computing competencies gained as a result of the subject took the same format as those about the subject delivery and the general statements about the subject. Again there were some differences between campuses because of the variation in delivery. The results are shown in Table 4.

Statement (1 Strongly disagree – 7 Strongly agree)	**Result**	
	Logan	**MtGravatt**
As a result of this subject I feel more competent and confident to use IT in learning	5.04	4.46
The workshops/tutorials allowed me to experience useful practical aspects of learning with IT	4.24	3.78
I found the online Applications material useful	4.40	4.10
I found the online Webster tutorials (in Excel, Word, Access) useful	3.88	-
The 1 hour tutorial length was adequate for my needs	-	2.34

Table 4: Results of statements about computing competencies.

The students gained computing competencies during workshops/tutorials and via online tutorials and independent practice. At Logan there was a two hour weekly workshop while at MtGravatt there was a one hour tutorial. It can be seen from Table 4 that the Logan student expressed a greater confidence about using IT in learning. This is important when compared with the lower rating they assigned to their IT competencies when entering the subject. This more positive result is also reflected in their response to the second statement in Table 4 regarding their workshop being a useful experience for learning practical aspects of learning with IT. The negative result (2.34) for the MtGravatt students' satisfaction with their one hour tutorial makes it clear where the source of their dissatisfaction comes from.

Statements about resources

The survey included statements about resources because there were considerable differences between the two campuses in terms of resources. Statements on this topic took the same format as the previous three sub-sections. The results are shown in Table 5.

Campus	**Statement** (1 Strongly disagree – 7 Strongly agree)	**Result**
Logan	I was able to access a computer whenever I needed one	5.37
MtGravatt	I was able to access a computer whenever I needed one	3.69
Logan	I found the *Book of Readings* useful	4.71
MtGravatt	I would have been willing to purchase a Book of Readings if one had been available	5.04
Logan	The library had adequate resources to meet my needs in this subject	3.71
MtGravatt	The sessional/off campus employment conditions of tutors did **not** create problems for my progress in this subject	4.16

Table 5. Results of statements about resources

The Logan students were much more positive about being able to access a computer whenever they wanted to (5.37) compared with MtGravatt students (3.69). The Logan students found *their Book of Readings* useful (4.71). This was made available to the Logan students because the library facilities on their campus were new and did not have the same book and journal resources of the MtGravatt library. However the MtGravatt students expressed a strong desire (5.04) to have a *Book of Readings* made available to them as well. Surprisingly the MtGravatt students did not seem to be concerned about the sessional nature of their tutors that resulted in their not being able to have face-to-face contact with their tutor between tutorials. They did have the compensation that as subject convenor I was available to them on their campus four days a week (the fifth was spent at Logan campus).

Conclusions

Evaluating subjects is always a sobering experience for academics – well it is for me anyway. Preparation for this subject had been enormous and had taken over six months. I had the solo task of preparing the Subject Profiles, the *Book of Readings*, all online material and lectures and then delivered the lectures, took one workshop group and managed four sessional staff on two campuses as well as dealing with all convenorship duties entailed in a subject with 350 students. To say that I was not overjoyed at the outcome would be an understatement, but in some ways I was probably not surprised. For example I was well aware that there would be problems with the lack of computing resources on the MtGravatt campus. This had been the reason that the one-hour tutorials had been scheduled in preference to two-hour tutorials - it had simply been impossible to timetable that number of hours in the available computer laboratories. This of course had the further consequence that there was little available time for students to do independent work in the computer laboratory. This problem is easy to solve by increasing the computer/student ratio and the university has undertaken to do this for the next cohort.

A more difficult question is the value of the flexible delivery. Admittedly, the subject evaluation survey was a fairly shallow attempt to gauge the student preferences with regard to online material compared with more traditional delivery methods such as lectures and tutorials. It did little to gauge the efficacy of the methods with respect to the learning that took place, except in so far as it rated students' beliefs in their own confidence and competence to use IT in their teaching profession. Certainly there was a more positive result in this regard on the Logan campus but this is more likely to have arisen from the difference in workshop/tutorial time allocated on the two campuses and the availability of computers for independent practice. The university has considerable investment in the online material that included not only my time in developing the materials, but also the services of the Flexible Learning unit of professional Web designers, programmers and technicians that had the responsibility for Web mounting the subject materials, as well as the infrastructure costs in computers and communication technology. The students clearly valued the online material but only as a suite of possible delivery methods of which face-to-face contact with a lecturer or tutor was the most important. What the online material does is provide a backup for the students where they have chosen to miss lectures for whatever reason and to reassure them that they all have available to them the core of the material regardless of differences between tutors. From the staff perspective, it is an advantage to be able to direct students to online material rather than have to provide personal tuition when special circumstances arise but at this stage the investment in my time comes no where near equalising this advantage.

My limited appreciation of online support for this first year undergraduate subject of internal (that is on-campus) students is not replicated however for post graduate external students. I also convene a Graduate Certificate of Computer Education that I made available via the WWW over the last two years. As a delivery method for these students, online materials have been an unqualified success and the course has attracted students from as far afield as New Zealand and Badu Island (a remote island in the Torres Straight to the north of Australia). It also does not apply to interactive components of the online subject delivery. All subjects I have Web mounted include a Forum (also called a threaded discussion or Web Board) where students can contribute comments or questions and read comments or answers from other students or staff. This has been an very useful for remote postgraduate students and was built into the assessment process for the undergraduate students who are the subject of this paper. Students were required to post their initial thoughts on various aspects of their group project on the Forum and their tutor gave them feedback on a weekly basis. This was a valuable developmental exercise for the students and improved the quality of their projects considerably but it is personally costly on tutors' time and needs to be well managed when used by large numbers of students such as a big first year subject.

So where to from here? With respect to the first year subject *Learning with Information Technology*, I have implemented changes that will see both campuses having a two hour workshop and a *Book of Readings*, neither campus will have lectures for the immediate future (a practical decision based on my absence from the university on sabatical) and the computing facilities on MtGravatt campus will be upgraded. With respect to the online material, further developmental work will be directed at improving interactivity as this is where the real power of online material lies. As for research, there is a huge need for in-depth work on the quality of learning that is taking place while students are engaged in interacting with online material, rather than just bowing to student preference or institutional dictates.

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How Can Computer Based Visual Mapping Tools Enhance Learning with Pre-service Teachers?

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Abstract:
Visual mapping tools are computer-based and are essentially two dimension and/or three dimension spatial arrangements of text and diagrams. Research has shown that these cognitive tools help teachers link curriculum content to instructional plans. Traditionally, it has been in the area of language and science education. This study extends this notion to include visual arts education. This paper will present the preliminary findings of a funded research study which used a visual mapping tool package in a visual arts studio setting with students training to be non-specialist teachers. The study highlights the benefits of these cognitive tools in allowing students to conceptualise and map their learning processes, while enhancing their visual learning.

Visual mapping tools are computer based, two dimension and/or three dimension spatial arrangements of text and diagrams. They have been used traditionally to link curriculum content to instructional plans, particularly in the areas of science and language. Research indicates that concept mapping is a reflective strategy to promote efficient and meaningful learning by connecting prior knowledge to new concepts. (Novak & Gowan 1984, White & Gunstone 1992, Ferry 1996a).

Concept maps use labelled nodes to represent concepts and lines or arcs to represent relationships between pairs of concepts. Studies by .Novak & Gowan 1984; Gallard 1994; Ferry, Hedberg & Harper 1998 contend that concept map structures parallel human cognitive structures as they demonstrate how learners organise concepts The use of concept mapping strategies with pre-service teachers has been acknowledged in the area of science education where researchers have reported how subject matter knowledge is organised. (Lederman & Latz 1995; Ferry et al. 1998).

While it has been recognised that concept maps act as tools to help learners organise their cognitive frameworks into more powerful integrated patterns, researchers such as Jegede, Alaiyemola & Okebukola (1990), Lederman & Latz (1995) and Ferry (1996b) contend computer based concept mapping goes further and assists pre-service teachers to organise curriculum content into powerful integrated frameworks. Importantly, Ferry et al (1998:2), argue that the process of concept map construction can stimulate a dialectic between curriculum content and pedagogical practice.

This paper takes the notion further and suggests that concept mapping can be employed by pre-service teachers to other disciplines, namely visual arts education, to actively develop understandings, map ideas and conceptualise meanings.

Creating Concept Maps

Six steps are recommended by Holley and Dansereau (1984) for learners to create concept maps. They are: selecting key concepts which is a recognition process which activates relevant knowledge and helps with topic identification; writing of the key concepts; listing the attributes of a key concept; forming spatial relationships which relate key concepts; rearrangement of the spatial representations; comparison of the representation to the text.

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White and Gunstone (1992), suggest that a period of direct instruction is necessary for success before employing the process.

The following instructional steps are recommended by White and Gunstone (1992): use a small number of familiar terms with students so they can concentrate on the learning process; modelling by the instructor of the construction process; encourage students to record all possible links; provide constructive criticism by the instructor as it is unlikely that first attempts will produce successful maps; for first attempts suggested layouts are helpful; inform students that there is no single correct answer to the text.

The Concept Map Tool Used in this Study

The concept mapping tool used in this study was created using Inspiration®, using Apple Macintosh™ computers. These computers are used across the campus at the University of Wollongong. The pre-service teachers in this study had at least one course on the application of information technology to teaching and learning (fourteen two hour tutorials during their pre-service teacher training course).

The concept map tool is defined as a cognitive tool in this study. Jonassen (1991:2) defines cognitive tools as generalizable tools that can facilitate cognitive processing. According to Ferry et al (1998:3), cognitive tools are both 'mental and computational devices that support, guide and extend thinking processes of the user'. These tools are 'external to the learner and engage the learner in meaningful processing of information'.

The cognitive tool Inspiration®, allows the user to create a variety of visual diagrams. The four visual diagrams are: concept maps, ideas maps, webs and story boards.
Inspiration® defines:
1. A *concept map* as a hierarchical diagram used to represent a set of concepts beginning with the most general or most important and then working down to more specific detail. Key concepts are connected with links which may have descriptive words explaining relationships.
2. An *idea map* is a visual brainstorming technique used to generate ideas and develop thoughts. An idea map has the main idea located in the centre of the screen with sub ideas linked and radiating out.
3. A *web* has a main idea or core concept at the centre with different categories of information connected to it. Ideas, facts and information are connected to the categories to support them.
4. A *storyboard* is a visual way to organise projects and displays ideas at the beginning, middle and end.

Method

A number of broad areas for exploration were developed and investigated by the researchers. For the purpose of this paper, the following specific questions are addressed:
1. Do computer based visual mapping tools assist or hinder pre-service teachers to organise curriculum content and knowledge to be effective instructors?
2. When using computer based mapping tools to construct knowledge, do differences exist when applying subject matter knowledge to different subject disciplines, such as Science and Visual Arts?
3. Can the creative process in Visual Arts education be represented and deconstructed as a cognitive framework in the form of a visual map?

During the research study twenty four volunteer pre-service teachers enrolled in their final year of Bachelor of Education (Elementary) training were invited to:
1. compare the use of the visual mapping tool created by Inspiration® to plan instruction in Science and Visual Arts education
2. use the visual mapping tool created by Inspiration® to analyse and deconstruct the creative process

Instruction Provided

Half of the group were given direct instruction in a lecture theatre which contained computer projection facilities, where the program was demonstrated and modelled by an instructor. Half the group were given the User's Manual provided by Inspiration® and worked in pairs to gain knowledge of the package through a self-paced inquiry mode. (Note: the reason for the variation in instructional modes will form the basis for other research outcomes). Each pre-service teacher was allocated a computer but was encouraged to collaborate with their peers when constructing their visual maps.

Data Collection

Data was collected through three main sources, ongoing written personal reflections, analysis of the visual maps produced and interviews. Interview transcripts, written reflections and visual maps were coded and analysed for trends and emerging themes.

In relation to the reflective data, at the conclusion of each stage of the visual mapping process students were required to reflect and comment on their practice.

The reflective practice took three forms:
1. an *open-ended reflection* where students were asked in pairs to discuss and write about their thoughts and initial impressions concerning the use of the package),
2. an *individual reflection* where students commented on the use of the package in two situations
-the visual mapping of prior knowledge of an artist and his/her work
-the development of a personal artwork
3. a *structured reflection* where students were asked a number of specific questions (See Appendix 1 for questions)

Brief Description of the Study

Students were given four specific tasks to perform over an eight week period which involved either/or both Science and Visual Arts education.

They were:
1. to plan a short program of work for a elementary class, using the visual mapping tool package Inspiration®, to conceptualise ideas, organise content and knowledge
2. to research and investigate an artist and artwork, gathering and recording as much information as possible
3. to construct a visual map of the information and knowledge gathered in (2) using the visual mapping tool Inspiration®
4. to plan the development of a personal creative response (artwork) using the visual mapping tool Inspiration® to conceptualise and organise thoughts, ideas, materials and processes

Results

The results are organised by the three research question posed for this study. Part 1 presents and discusses the data and helps to clarify understandings on how pre-service teachers use visual mapping tools to organise content and knowledge. Part 2 presents and discusses data on how pre-service teachers use visual mapping tools to organise ideas and deconstruct existing knowledge in the Visual Arts discipline area. Part 3 presents and discusses data on how pre-service teachers use visual mapping tools to conceptualise, organise thoughts, ideas and materials to develop a personal creative response.

Part 1: Do Computer Based Visual Mapping Tools Assist or Hinder Pre-service Teachers to Organise Curriculum Content and Knowledge to be Effective Instructors?

It was clearly evident that all students agreed that the visual mapping tool package Inspiration® assisted them with their organisation of curriculum content and knowledge. The students were able in a very short period of time in visually representing their knowledge and conceptualising in both subject disciplines. Many students reflected that it provided a clearer way of thinking and more efficient. It allowed the students choice in changing thoughts, conceptualising and recording their ideas. The students unanimously agreed that they would use the package again to prepare and plan their pre-service university course work. Students made positive comments on the transferability to the teaching context. They believed that the visual mapping tools would enhance their abilities to be more effective instructors. These results are congruent with earlier studies conducted by Ferry (1996, 1997) and White and Gunstone (1992).

Note: a number of criticisms/annoyances were raised by the students about specific actions relating to navigation which occurred when using the package. These points will be discussed in detail later in the paper.

Part 2: When Using Computer Based Mapping Tools to Construct Knowledge, do Differences Exist when Applying Subject Matter Knowledge to Different Subject Disciplines, such as Science and Visual Arts?

After data analysis it could be concluded that the students felt that differences were evident between the two disciplines when using the visual mapping tool package Inspiration®. Students generally commented that at first differences occurred when planning instruction between the two disciplines, but later when attempting to conceptualise knowledge, greater differences were apparent. This could be possibly be attributed to the nature of the task. That is, in the Science activity and the initial Visual Arts activity, the pre-service students had researched the topic area which was to be visually mapped. While, in relation to the Visual Arts activity, the students were required to gather knowledge about an artist/artwork and visually map this. This required the students to make decisions, find categories, explore ideas, gather like concepts and represent them visually.

It is interesting to note that Inspiration® provides two main views or environments: Diagram view and Outline view. When in Outline view the main idea appears as text at the top of the outline while the supporting topics and subtopics follow in hierarchical order, where notes as text can be added. Students used this mode extensively in this study.

Part 3: Can the Creative Process in Visual Arts Education be Represented and Deconstructed as a Cognitive Framework in the Form of a Visual Map?

In this study students were asked to plan and develop an artwork using the visual mapping tool Inspiration® to organise their ideas and thoughts. The New South Wales Visual Arts syllabuses (Years 7-10 and 11-12) broadly organise and describe art practice under the broad headings of three kinds of artworld practice: artmaking, art criticism and art history. For the purpose of this exercise the basic tenets of this syllabus were applied relying on the area of 'artmaking'.

A characteristic identified in the syllabus for the area of artmaking involves an understanding and application of a process. Students are required to utilise actions of exploring, developing and resolving. For this exercise the visual mapping tool was used at the 'exploring' stage of the process.

In this sense, when involved in the process of exploring, students were encouraged to think imaginatively, explore ways of looking, interpreting and responding to subject and forms. Students were required to make decisions about materials they might use or experiment with, the subject matter they might explore and the influences that impact on their 'artworks'. In other words, butcher's paper, scrapbooks and pens or visual process diaries were replaced with a visual mapping tool for students to organise their ideas.

From the visual maps provided by the pre-service students in this study and the analysis of the results it appears that the creative process can be represented and deconstructed as a cognitive framework in the form of a visual map. It is the researchers' belief that the development of and deconstruction/analysis of an artwork is a common practice in art education, but development of and deconstruction/analysis of an artwork using a visual mapping tool is a particularly unique phenomena.

In response to this activity one student stated:
'Inspiration allows the user to think visually, go off in any direction, and follow that idea to its logical conclusion, then come back to a past thought and go off in that direction. This is a great advantage as when someone thinks about a subject or topic they often come up with several ideas to follow, they then go off in one direction, often forgetting about their original thoughts, leaving them with a limited view of their subject. Another advantage is the ability to include notes behind the surface of the concept map allowing thoughts to be explained or expanded upon. Concept maps generally allow people to communicate their ideas to other people, this package helps do this in a very efficient and clear way.'

Other Areas of Investigation/Emerging Themes

This paper has only addressed a small area of the total research project. Other areas presently under investigation and proposed for future research include: the relationship between learning styles and the selection of visual mapping formats; the difficulties experienced in navigation by the pre-service teachers when using the visual mapping package, such as, screen size and printing problems; the problems of visualisation and the need for a package which could import visual or photographic images to enhance the deconstruction process; and the issue of cross-cultural applications when using the packages. In conclusion, further investigation, including the use of hyperbolic trees to present screen data, is being presently explored, as well as research to ascertain whether a particular learner, or learning style is better suited to this method of knowledge mapping.

Conclusion

In conclusion, a number of significant findings have been addressed in this research project. Students all agreed that the visual mapping package has enabled them to:

1. plan more efficiently
2. conceptualise their knowledge and ideas more clearly, allowing them to use the process successfully in two subject disciplines
3. make their thinking processes more explicit.

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Appendix 1

Final Evaluation - Inspiration®

1. Inspiration was developed to help you think and learn visually. The package provides you with the tools to let you create a picture of your ideas or concepts. Comment on the success of the package in light of the above statement.
2. With Inspiration, learning and thinking becomes active rather than passive. Is this statement true? Why/why not?
3. How could you use Inspiration with children?
4. Which of the following maps best describes your thinking processes?

Integrating Technology for Moral Education in the Student Teaching Practicum

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Abstract: Faced with a 23% population increase during the 1998-1999 school year, the faculty of a small rural K-12 Wyoming school realized that major intervention efforts would be needed to facilitate the absorption of the new students. The plan was to adopt a school-wide code of conduct: the law of kindness, and utilize the involvement of a student teacher in the language arts department, with the promotion of multi-media activities which would encourage students to express beliefs and values about interactions with each other in creative and interesting ways. The student teacher was involved in providing instruction in multi-media applications skills development as well as facilitating student project development. Various computer applications utilized in the classrooms provided the students a creative and challenging medium by which they could demonstrate concepts learned in morals and ethics, through multi-media presentations at a bi-annual celebration of the arts: the 15th all-school Drama and Fine Arts Festival.

Introduction

This project took place in Rock River School, in Rock River, Wyoming. This K-12, isolated rural school had a student population of 116 at the end of the 1998 school year. At the start of the 1998-1999 school year, the population rose to 152. The school was enrolling significant numbers, proportionately, of new students from four different locations, who were all choosing to come to RRS for different reasons. The faculty knew they had to assist with the absorption of the new, diverse student population, or serious fragmentation of the student body would take place. At the same time, the school was notified that it had been a grant recipient of a large sum of money that was intended for the development of curriculum to teach morals and ethics. In addition, the school was notified that a student teacher from the University of Wyoming would be placed with Rock River's language arts teacher. The faculty elected to use the grant initiative as well as the services of the student teacher, as two approaches to solving the problem of helping the new students mesh with the old-timers. Representatives from the University of Wyoming College of Education were recruited to help determine if direct instruction in the teaching morals and ethics through multi-media did have an impact on the students. The student teacher, who had already earned a master's degree in American Studies and was just completing his teacher certification, was most intrigued with the concept of

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attempting direct instruction in morals and ethics. The purpose of the research was to determine whether or not interventions based on direct instruction in morals and ethics, which were demonstrated through multi-media, had a meaningful impact on a significant number of the students. The basis of the data collected was transcribed student interviews and written commentary from student reflections, primarily taken from the language arts classroom and also from the music classroom. In addition, anecdotal statements from the principal regarding school discipline were solicited. Also, selected teachers offered reflections about the impact of the initiative.

Background

Rock River School, a small, isolated rural school in Wyoming was facing a 22% increase in student population. Large groups of students were choosing to come to RRS for different reasons. One school located to the north of RRS, in a different county, closed down and their secondary students were going to be bused elsewhere. RRS was a viable option for those students. RRS serves as the secondary school for many of the area ranches, and a group of those students matriculated to the 9th grade (i.e., finished with their elementary education on site on the ranches). Also, RRS serves as the destination school for selected K-12 students bused from Laramie, 40 miles to the south, who want the "small, rural school" experience. Working all of those distinct groups into the RRS mainstream was going to be a challenge. At this time, as a part of a grant from Reader's Digest and DeWitt Wallace Corporation, the school agreed to develop a curriculum designed to provide direct instruction in morals and ethics. The initiative in morals and ethics instruction seemed to provide the framework to address the needs. Six classroom teachers elected to participate in the grant activities: Language Arts, Family and Consumer Science, Art, Music, and Health. A student teacher from the University of Wyoming, who was assigned to the language arts classroom, joined the team and participated in all aspects of the grant initiatives. Through work in using various computer applications in the language arts classroom, he assisted students in preparing their mulit-media presentations about what they learned about morals and ethics. In addition, by the time he was done, he used multi-media to prepare his own professional portfolio that is required by the College of Education as a graduation outcome.

Procedure

Six classroom teachers in the RRS secondary addressed morals and ethics in their lessons during the year. In the English room, a literature-based approach to morals and ethics provided numerous examples of stories, plays and essays that raise moral questions. Students were given the chance to reflect (in various ways) about the moral questions raised by the literature. The moral issues raised by student publications were examined. In addition, the students created mini-dramas that reflected the moral and ethical choices and consequences, and then used them as videos in their multi-media presentations. The student teacher was instrumental in helping the student write the mini-scenes, rehearse them, film them, then capture the video to include in their multi-media presentations. In the Business class, morals and ethics in the workplace were examined. A first-ever "mock trial" was staged to examine morals and ethics pertinent to business law. In the Family and Consumer Science class, students were asked to determine how universal values affect their self-concept and personal feelings of self-worth. In Health class, the morality of the drug culture was examined. In Music, through the vehicle of two country-western songs, students examined and reflected on the impact of music that is designed to teach morals and ethics. The two songs are "Don't Laugh at Wills and "Random Acts of Senseless Kindness" by South-Sixty Five. In the Art class, various unusual cultures were examined for their unique contributions to the human condition.

School-wide Projects Attempted

At four different times during the school year, the entire K-12 student body was called together for projects designed to apply morals and ethics. The first project was building team work, after an especially long and tiresome discussion of the student handbook on the first day of school. The students were placed in groups by random numbers, and those groups comprised the first sports teams of the school year. The second school-wide project was called "adopt -a –disability- for –a- day- and –rely- on-a-trust-partner- to- help- you- through- the- day." The students were paired, and then each set was given a contrived "disability." Some were partially "blinded" with glasses made from waxed paper. Some lost the use of hands; some were in wheel chairs. Some had ear plugs because they were "deaf," and some had to wear weight vests with an extra 50 pounds in them. The third school-wide project was "I Am a Member of the Seventh Generation." The students heard the Native American myth of White Buffalo-Robbed Woman, who in the past had taught Native Americans how important it was to care about future generations, those seven generations in the future. The students were paired with elementary students, and they were asked to get to know children who they didn't know or who were new to the school. The activity was especially meaningful, because one of the senior boys, the salutatorian of the class of 1999, himself was a member of the Northern Arapaho nation. He presented the myth of the White Buffalo-Robbed Woman to the students. He was an especially well-liked student who practiced daily morals and ethics with his fellow students, as though they were second nature to him, because they were. The students listened when he spoke, and they took his words to heart. The final project was the 15th RRS Drama and Fine Arts Festival, where students showcased much of the learning that went on during the year, through the performing arts. For example, advanced technology taught by the student teacher in the language arts classroom, was used to showcase the 7th and 8th grade examination of health-related issues. The theme of the Drama Festival was "Teen Choices and Consequences." The Drama Festival had K-12 involvement.

Tools Used

In order to create the student mini-scenes that were a part of the 4th quarter Drama Festival presentation for the 7th and 8th graders, the student teacher and students used Microsoft Works and Microsoft Word to write and edit the scripts. One critical piece in this entire project was the ability to edit the scripts down to a manageable size. At first the students had trouble with the editing, but after they saw the size of their video clips, they understood the reason for the critical, discriminating editing. After filming on to tape from a Sony Panasonic Camcorder, the student teacher used Adobe Premier to edit the small scenes. The presentational vehicle used was Hypercard 2.3. The choice to use Hypercard rather than a more difficult presentational package was a conscious one. The students would have to prepare their presentations on LCII and LCIII computers available to them in the school's one Mac lab. While some applications such as Hyperstudio and Powerpoint were available on some machines, they are not available on all of them. In the next step, the abbreviated, edited videos were added to the Hypercard stacks on the G3 or the Powermac 7500 with a G3 processor, which are located in the English room. The student teacher was able to arrange a workable schedule for each of the 4-member student groups in grades 7 and 8 to get their turn on the two high-powered machines available. While using the tools, the students learned many lessons in group dynamics, collaboration, and team work. The student teacher once told me about some friction among some seventh grade boys, and his response was, "No, you can't quit the tour just two days before the show."

Conclusions

In order to determine the success of the instruction in morals and ethics, several procedures were used. First of all, after every school-wide event, students were randomly placed in "debriefing" groups, and with a teacher-leader, their feelings were aired and examined. A secretary for each group recorded observations. Then those thoughts were shared with the K-12 population of the school. Because of the student teacher's presence in the building, the faculty was able to divide the groups by one additional member, which further allowed the student teacher to be involved in the entire grant initiative. Further, at two times during the school year, Dr. Carol Bryant from the University College of Education came and interviewed a random selection of students about their thoughts on the effort. Those interviews were taped. The six teachers on the grant committee each submitted questions and likely student interview subjects, without collaboration among the members. The interviews revealed that students were really thinking about their actions before they took them, and many commented that they were more aware of kindness and compassion in the school. In English class, end-of-year reflections of the meaning of the initiative became the subject matter for final compositions. The student teacher pre-taught, assisted with the composition, and then evaluated the student written work. During the fourth quarter of the school year, a small contest was organized by the Student Council to determine the students who could demonstrate "random acts of senseless kindness" and be observed by an adult in the building. The senior class won the competition, and then instead of "blowing" the $100.00 cash prize on their senior trip, they elected to host a bar-be-que for the faculty and staff on graduation day. In a closing interview, Principal Charles Cashman commented that serious discipline problems had gone down, and the number of serious suspensions also was significantly reduced from previous years.

During the interviews, students were asked if they thought the emphasis on the Law of Kindness made a difference in the school. Student responses were analyzed for

indicators of change in attitude and responsiveness to the project. Student responses to the questions, as well as personal reflections at the end of the year, were generally positive for the impact of the initiative. Sample comments from the end of the school year included:
SY, 9th Grade: "I also learned to be kinder and to be more patient….but because of this activity, I understand how much the teachers were stressing kindness and I tried harder to be a better person."
MW, 9th Grade: "I have become really comfortable in this school."
BR, 9th Grade: "The grant taught me that kindness is an important element in this day and age. I think almost everyone learned something from it."
However, not all students felt the same.
KL, 8th Grade: "The most important thing I learned this year is that no matter how much teachers preach about kindness, all ages will still be cruel. All year long, the teachers here at RRS have spoken of kindness. Few, if any, have listened."

Further, the integration of multi-media in the English classroom, implemented by the student teacher, created a high level of motivation among students to seriously consider the morals and ethics lessons associated with the grant initiative. When multi-media projects were begun, student discipline incidents diminished, students came in for extra time and assistance, and they were actively engaged in the learning process. The student teacher discovered that the project approach using multi-media was a viable teaching technique that could be managed, even by a pre-service teacher.

Implications of the Entire Initiative

1. The grant monies provided special, unique opportunities for the students and teachers of RRS.
2. The grant initiative did indeed bring diverse faculty members together, out of necessity, to organize the activities. Those who would not normally keep company with each other, found themselves bonding with peers out of their normal group of friends.
3. The student teacher was able to build and maintain relationships with teachers who taught out of his discipline area, who also worked on the grant initiative. The interactions were positive and helped him develop a more global perspective of what the school was trying to accomplish.
4. Direct address of morals and ethics had an impact on many students. However, there is still work to be done.
5. Because of his computer training at the University of Wyoming, the student teacher
6. was able to provide assistance in the classroom with the students with various computer applications in a meaningful way.
7. Student teachers must be trained to integrate various computer applications and technology into daily lessons.
8. Student teachers must be trained in team-building, collaborative learning activities that may be out of the normal range of teacher activities.
9. Student teachers must be trained to use a project approach when appropriate.

10. Student teachers must be able to manage a project approach to various activities and not be threatened by such activities.
11. Student teachers must be willing to spend the time necessary to learn what new information is required of them, regardless of the time it takes.
12. Direct school-wide activities about morals and ethics, including activities to share feelings after an assembly, allow for good interaction among students.
13. Random selection of students for various groups involved with the grant initiative forces students to interact out of their typical groups.
14. The initiative must be continued in future years… students, staff and principal felt that way. Now the education must go on because it is the right thing to do, and not because there is a price tag attached to it.

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Two distinct sources were used as the foundation for the project. The teachers used these sources as guidance in some of the planned activities with the students

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Preparing Teacher Candidates for the Integration and Implementation of Appropriate Technology: A Triad Approach

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Abstract: This paper is a description of initiatives in one teacher preparation program to prepare its candidates for the integration and implementation of appropriate technology. The paper will include descriptions of specific assignments, projects, and learning experiences designed to engage the teacher candidates in enriching technological experiences to enhance their own learning while at the same time serving as a model for teaching. The technology integration approach implemented focuses on a triad model that identifies three areas of technology infusion: communication, productivity, and research/instruction. This triad model demonstrates one approach for designing curriculum and appropriate experiences in a teacher preparation program that provides hands-on experience.

Introduction

Teacher education programs are faced with the challenge of preparing candidates for a technology-rich teaching profession. With innovations in technology growing exponentially and current research in teaching and learning advancing, the challenge can be quite daunting. Accreditation agencies such as *the National Council for Accreditation of Teacher Education* (NCATE, 1997) and discipline specific organizations such as the *National Council of Teachers of Mathematics* (NCTM, 1989) have proposed guidelines for preparing future teachers in the use of technology for instruction. These guidelines emphasize the importance of the appropriate use of technology for teaching and learning in both content and pedagogical studies for teacher preparation.

The International Society for Technology in Education (ISTE, 1996) proposed educational technology foundation standards in three areas: Basic Computer/Technology Operations and Concepts, Personal and Professional Use of Technology, and Application of Technology in Instruction. ISTE advocates that teacher candidates should be able to use a variety of software and technology tools to communicate, solve problems, and support instruction in their grade levels and subject areas. These guidelines provide a framework for teacher preparation programs and higher education faculty to build exemplary certification programs to prepare future teachers for the appropriate use of technology.

In 1996 President Clinton and Vice President Gore unveiled the Technology Literacy Challenge (U.S. Department of Education) that advocated a 21st century where all students in the United States would be technologically literate. The challenge outlined four goals to address an aggressive technology vision. The goals focused on teacher training and support, computer access, internet accessibility, and appropriate integration of instructional software. Woven into those goals were strong implications for teacher preparation programs to provide innovative technology instructional experiences for its candidates.

At present most preservice teachers know little about how to use technology effectively for instruction (Willis & Mehlinger, 1996). A recent survey of teacher-preparation institutions conducted by the International Society for Technology in Education, commissioned by the Milken Exchange on Education Technology (Moursun & Bielfeldt, 1999) revealed that teacher preparation programs do not provide their candidates with sufficient experiences to prepare them to use technology effectively in their classrooms. The greatest problem lies not in the availability of technology, nor in the actual technical use of the

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technology, but in the integration of technology in curriculum and instruction. The survey further found that most preservice teachers do not ordinarily use technology during field experiences and that university faculty do not model the use of technology routinely. The report proposes a more integrated model for the effective use of technology in instruction with both student teachers and faculty applying integrated technology.

The University of Georgia's efforts to integrate technology into their teacher education program (Schrum & Dehoney, 1998) demonstrate that with support, modeling, and proper training preservice teachers can experience success in using technology. They found that attitudes toward the use of technology improved and confidence in their own abilities to use technology increased. The preservice teachers also were able to articulate potential uses of technology for their future classrooms. Efforts such as this indicate that teacher education programs must move to a level of integration of technology for their candidates to be prepared to use technology effectively for instruction.

This paper will describe initiatives in a university teacher preparation program to prepare its candidates for the integration and implementation of appropriate technology. Descriptions of specific assignments, projects, and learning experiences designed to engage the teacher candidates in enriching technological experiences to enhance their own learning while at the same time serving as a model for teaching will be included.

The Triad Model

The technology integration approach implemented focuses on a triad model that identifies three areas of technology infusion. The triad categorizes the three areas as communication, productivity, and research/instruction. The triad model (Fig. 1) applies to discipline specific methodology courses, general curriculum courses, and practicum experiences such as student teaching. Over the past four years modifications and revisions based on ongoing research in classroom practice have provided an experiential foundation for the integration of technology in both coursework and field experiences of teacher candidates.

The teacher candidates engage in authentic learning experiences where technology is a tool among many other resources that is provided as a venue for learning. The triad model is used to illustrate that the three components of communication, productivity, and research/instruction are interrelated. Linkages between the triad components are essential for the understanding of the model and the true integration of technology in instruction.

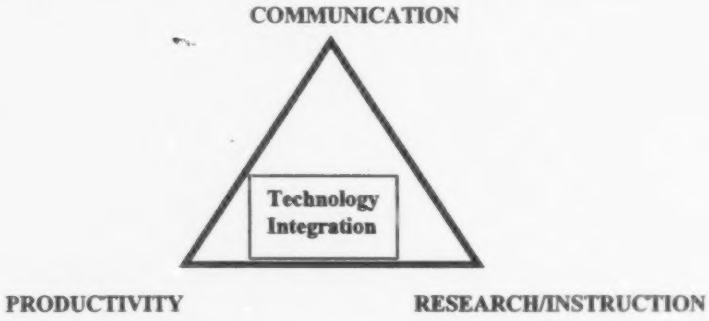

Figure 1. TRIAD MODEL: INTEGRATION OF TECHNOLOGY IN A TEACHER PREPARATION PROGRAM

Communication Component

Appropriate use of technology can facilitate communication between and among various groups involved in teacher preparation programs. Both e-mail and video conferencing were used as tools for communication between preservice teachers, university instructors, and curriculum experts. Preservice teachers at the university used e-mail as an avenue for communicating with their peers located at the same university, as well as with other students involved in teacher preparation at universities in other states. These experiences began with direction from the instructor with various guidelines for implementation. The students began to branch out on their own and use the e-mail vehicle for continued collaboration and support. Results showed that the students continued the dialogue more within their own university than across states. Future collaboration with teacher preparation candidates in other locations needs to be more structured with sufficient time given for the communication.

The use of e-mail also facilitated communication between the preservice teachers and the university instructor. Not only were there required assignments such as reflective journaling while completing field experiences, utilizing e-mail communication but the e-mail vehicle continued to be used by the preservice teachers as a means of support for both course work and field experiences. It was found that this means provided immediate feedback for timely communication. After the field experiences and course work many students continued to make the connection with the instructor through the use of e-mail. This has given them useful support and feedback.

At the university a video conferencing session was held with one class of preservice teachers enrolled in a secondary mathematics methods course. The group participated in a discussion with the author of the text used by the students in the course. The class prepared for the experience by developing questions and topics to engage the guest curriculum expert dealing with issues related to the text and course. The guest author made a brief presentation, addressed various questions from the students, and engaged the students in a discussion of current topics in the field of mathematics education. The students noted that this experience not only gave them an opportunity to interact with an expert in the field whom they might otherwise not encounter personally, but also modeled a use of technology that they may use in their own classrooms in the future. The preservice students were able to relate both technical and curriculum issues in utilizing such technology.

Both the experiences of e-mailing and video conferencing provided a wide range of opportunities for the preservice teachers to engage in professional dialogue with colleagues. They were able to identify benefits and issues related to the use and implementation of such technology for their own future use as teachers. Communication was modeled through an integrated approach.

Productivity Component

According to Forcier (1996) the computer can be seen as a"multifaceted tool" (p. 2) and serve both teacher and student as a productivity tool. His reference includes both personal and instructional productivity for the user. In the Triad Model productivity refers to personal productivity and support of instruction. Actual classroom instruction is addressed in the third component of the Triad Model - research/instruction. Computer technology was used by the preservice teachers at the university for personal productivity in the form of word processing, e-mailing, and presentation software packages. While word processing is possibly the most common form of productivity software, the preservice teachers were required and encouraged to combine it with the use of digital camera images and scanned images to enhance their documents. The preservice teachers began to find creative uses that saved them time and produced more professional materials. As they became more comfortable using the technology, they were able to initiate its use as needed without an actual assignment by the instructor.

Other examples of student use of technology for productivity were through the selection of multimedia presentation software packages such as *Power Point* and *HyperStudio* when given assignments such as personal literacy portfolios or group project assignments. As an example, preservice teachers enrolled in a graduate curriculum course were given an assignment to develop a personal literacy portfolio addressing multiple literacies. They were instructed to use a presentation medium of their choice. Many produced effective presentations utilizing a wide range of technology tools. When assignments such as this were given so that an option of type of presentation was allocated, many students in the teacher education programs chose to use computer technology. The students cited as reasons for their choice ease of use and more appropriate format for their content or topic.

Research/Instruction Component

A third component of the Triad Model addresses the use of technology for research and instructional purposes. As preservice teachers begin to integrate university course work and field experiences it is important for them to explore the role of technology in this capacity. Opportunities to use internet resources and educational instructional software are essential for their development as effective teachers. Preservice teachers at the university participated in a Web Quest as a model for integrating internet resources, curriculum content, and research. The results of their experience were presented through multimedia presentations. Others were able to implement particular instructional software packages in their classrooms as student teachers. One such student teacher was able to have extensive experience using *Geometer's Sketchpad* with students. This experience was very successful in part because the student teacher had worked with the software in the university courses and then had it modeled by her supervising teacher with students. This multiple, integrated approach provided a strong foundation for effective use of the instructional software.

In a secondary mathematics methods course students were assigned a project based on the book *G is for Googol* (Schwartz, 1998). The project required the use of a *Power Point* presentation that would relate appropriate mathematical content to secondary students based on the information in the book along with other sources and activities. Students connected literature, technology, and mathematics content addressing both research and instructional ideas.

Preservice teachers became more critical users of instructional technology through these experiences. They also expressed renewed interest in applications of various technology resources that they had experienced in their course work at the university. Some preservice teachers expressed frustration when appropriate technology was not available in their field experiences. More importantly, they were disappointed when the technology was available, but was not utilized and modeled by their supervising teachers.

Conclusion

Teacher education programs must meet the challenge of preparing teacher candidates for the effective use of technology for instruction. The three areas of communication, productivity, and research/instruction addressed in this model provide a foundation for such a program. All three areas are essential and are interrelated in their use.

It is critical that teacher candidates actively participate in an engaging technology model that prepares them for their future as innovative, effective classroom teachers. In establishing expectations for accredited schools of education, NCATE (1997) advocates that teacher candidates complete experiences that use technology in their content areas along with experiences in the use of technology in instruction, assessment, and professional productivity. The triad model described in this paper is built on such expectations. This triad model demonstrates one approach for designing curriculum and appropriate experiences in a teacher preparation program that provides hands-on experience.

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Electronic Portfolios for Learning and Assessment

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Abstract: Two innovations, performance assessment and information technology advancements, provide the prospect for wide-scale use of electronic portfolios as an assessment tool. In a time where national and state standards are recognizing and incorporating technology literacy requirements into preservice teacher education, electronic portfolios offer benefits beyond their ability to easily manage and store data. There is evidence that using hypertext and multimedia tools to create a presentation of one's competency involves a range of higher order complex thinking skills. Putting the process of assessment in the hands of the student, portfolios produce tangible evidence of a preservice student's ability to connect theory to practice to create meaningful learning experiences for their students. As technology tools and skills become more commonplace, and the expectation of technology literacy more universal, electronic portfolios can serve as authentic assessment tools that provide a rich repository of information about teaching and learning.

Introduction

Portfolios represent the next logical step in applying performance assessment to constructivistic learning theory (Boulware & Hold, 1998; Richards, 1998; Barrett, 1999; Read & Cafolla, 1999; Tichnor & Sipek, 1999). According to constructivism, the learner plays an active role in knowledge building leading to deeper understanding and retention of this knowledge (Bruner, 1986; O'Neil, 1992, Leeman-Conley, 1999). Portfolio assessment models rely on the learner as an active player in representing what they have learned through a purposeful collection and explanation of their work (Wiedmer, 1998). Portfolios offer an on-going and summative documentation of a person's knowledge, creativity, and personal perspectives.

In 1991-1992, Vermont became the first state to use portfolios on a state-wide basis for assessment of math and writing ability of 4th and 8th graders (O'Neil, 1993). In 1995 this was extended to a results-orientated program approval process for teacher certification, evaluation by portfolio, placing this evaluation in the hands of the institutions of higher education that serve those pre-service students (VISMT, 1995).

As states, districts, and schools are adapting portfolio assessment strategies, corresponding problems associated with issues of storage, organization, dissemination, and inter-rater reliability are emerging (O'Neil, 1992; Barrett, 1998). How do we manage all this new information? How do we allow a personalized representation of knowledge yet develop uniform criteria to fairly assess it? How can we facilitate connections and reflections between theory and field experiences and how can we be assured the learner can present their knowledge to an array of audiences?

Some solutions to these problems seem intertwined with our struggle to define and implement technology literacy standards for pre and inservice educators. (National Council for Accreditation of Teacher Education, 1997; International Society for Technology in Education, 1999). There is added value in using new technology to document pedagogical competency through electronic portfolios. Electronic models streamline storage, facilitate dissemination, organization, and easy updating of documentation (Wiedmer, 1998). Portfolios can be easily shared for feedback, models distributed to students, and the electronic nature facilitates documentation for research about patterns of what creates a good educator. There is evidence that electronic portfolio construction helps students focus more on the content and connections of theory and practice than traditional paper-based models. Hyperlinking

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allows the student to connect course work, applications, ideas, and themes through a network of designed nodes, assisting them in reflection and enlightenment (Jonassen, 1996). Multimedia features support multi-intelligence theory allowing expression in text, video, animation, and sound (Moersch and Fisher III, 1995). Student's portfolios can be richer, sharing work otherwise not possible and presenting what they've learned and who they are as a teacher in a creative, personal representation. Finally, there is no better way for students to document their technological competence than to create their final assessment using a hyperlinked, multimedia based instrument.

The Portfolio Process

To respond to the 1995 Vermont State requirement for teacher certification, the Elementary Education Program at the University of Vermont encourages students to use the power of multimedia to construct electronic portfolios. Beginning in their first year, students enroll for a required technology course: Computers in the Elementary Education Classroom. In this class students learn basic computer skills and applications, and discuss technology-related issues. One third of the class is dedicated to teaching HyperStudio, the software used for building portfolios. At this stage, students are taught how to use the program's multimedia and hypertext tools to allow documentation of their work with children, coursework, with artifacts from their first year as a preservice student. They are encouraged to select particular products that showcase their learning, and in a caption, provide the context of their document and justify their selection with a reflective statement. They are taught how to design their presentations to include easy navigation, facilitate the reading of large text fields, scan, and work with digital photographs. They learn how to plan their presentation through story boarding and how to organize their information with sensitivity to layout techniques, color, and design.

Barrett (1998) has developed a matrix to help educators decide which portfolio tool meets their needs. These include a range of HTML and multimedia solutions corresponding to the level of technology proficiency and student-teacher control. Our interests were in creating a student-centered model and after exploring a number of programs, we selected HyperStudio. The program is popular in our neighboring schools, easy to use and yet provides sophisticated features that offer flexibility for students to control what and how they represent their learning. The program is self-sufficient with built in multimedia tools and a player readily available on the Internet in Mac and Window platforms to permit final products to be seen on almost any computer. The program allows for easy importation of text and sound and graphic files from many formats. QuickTime video and slide shows can be brought in, animations constructed, and final products uploaded to the internet, saved to a variety of media, or mailed via FTP (file transfer protocol).

Students' electronic portfolios are maintained on the College of Education and Social Service's server for easy access throughout the students' academic and professional course work. All residence hall rooms are networked with access to the College's server and a computer facility, The Technology for Teaching Lab. This is a college-based lab supervised by a full time technology coordinator and staffed by workstudy students who support faculty and students working on computer based assignments or projects or exploring technology tools. Most of the workstudy students are pre-service educators and have completed the required computer course and are thus familiar with the applications and student assignments. The lab has scanners, a writeable CD-ROM, and computer with the capacity to convert video movies into digital ones for incorporation into electronic presentations.

The use of HyperStudio to develop teaching materials is a new assignment recently introduced into a third year elementary education course in the inquiry block, an interdisciplinary based methodology course in science, social studies and art. In this assignment students develop a multimedia stack as one activity in a student constructed science center. Students build these around science content, set them up and leave them in their field placement classrooms for two weeks. Science Centers must be self-sufficient with activities and assessments about science content and processes. Creating a multimedia based resource helps preservice students demonstrate their ability to develop grade-appropriate content, organize information in a logical interesting way, and use technology tools to present this to an elementary audience. It also reestablishes student's familiarity with HyperStudio, preparing them for their senior portfolio experience.

While students complete their internship in their final year of our program, they participate in a one-credit portfolio course where they are given specific direction and skills related to assembling their final professional portfolio. At the University of Vermont, professional portfolios must be organized as a text, via themes of practice with student selected documentation that describes them as an emerging teacher. State and Program criteria are located in appendices and cross-referenced to the documentation. Students collect, select, and connect the artifacts. Documentation is captioned to explain the context and relevance of the evidence and invites the pre-service student to reflect about how it translates to a meaningful learning experience for their students. Pre-service students are expected to relate educational theory to practice drawing upon their coursework, fieldwork, and community experiences to create personal profiles.

Portfolios showcase learning and demonstrate professional competency and electronic portfolios facilitate this process and scope of expression. Evidence includes a rich assortment of artifacts: papers, homework, video, pictures, projects, diagrams, notes, animation, student voices, and music. In constructing their portfolios, students learn from the process and product as well as demonstrate their ability to use integrated technology. Beginning portfolios electronically in their first year ensures students possess the technology skills they need to succeed as undergraduate students at the university, in their field placements, and as prospective teachers. This serves as a vehicle for infusing technology throughout their college and field placements and begins their documentation of their education and professional competence.

Advantages

Teachers and administrators who have used electronic portfolio documentation have reported they make it possible to portray one's educational philosophy by helping them summarize their beliefs and attitudes into a compact multidimensional product (Wiedmer, 1998). Electronic portfolios demonstrate organization and presentation skills, facilitate the ability to make cognitive connections between themes, and offer multimedia for a rich choice of expressive modes. There is also evidence that in creating multimedia-based hypertext presentations, students practice complex thinking and express creativity (Jonassen, 1996).

Management

Electronic portfolio construction offers several advantages over traditional paper-based models. Distribution of portfolios to faculty and potential employers becomes simple with the ability to save to disk, CD-ROMS, and Zip and super disks in both Macintosh and Windows formats. Products can also be uploaded to an Internet site or e-mailed to facilitate the ability for graduating students to seek employment in diverse and distant communities. In a study of school administrators' reactions to electronic portfolios, portfolios were found to be powerful marketing tools during the interview process demonstrating technology expertise, presentational organization, content and pedagogy (Giuliano, 1997). Numerous copies can be easily and inexpensively duplicated, offsetting the risk of loss of the singular paper based format. They are easier to share making it possible for students to see a variety of exemplars and helping students "stand on the shoulders of giants" so they see other perspectives of teaching and learning and challenge their own practices and beliefs. Electronic portfolios are easy to edit permitting a continuity of documentation of growth with the control of distribution in the hands of the student. Yates (1999) reports that substantial revisions involve reflection on course content encompassing processes like reordering and reevaluating, resulting in new insights. If left on a server, assessment can be formative with a stream of faculty-student and student-student interactions that fine-tune the portfolio. Electronic documentation also provides a reservoir of data about the teaching learning process that with analysis and organization offers an opportunity to understand what constitutes a good teacher and good teaching.

Interactive Multimedia

Multimedia refers to communication from more than one media source such as text, audio, graphics, animated graphics and full motion video. (Sharp, 1999). In the past we have made presentations using different media but we had to combine slide projectors, cassette players, video players, and overhead projectors to achieve these effects. The change lies in a combination of all these different media handled by just one machine, the computer. The computer injects a level of interactivity into multimedia permitting an element of input via keyboard, mouse, and voice. Multimedia features allow students to include sound, graphic, and video components, in addition to traditional textual data. According to multiple intelligence theory, not only do all individuals possess numerous mental representations and intellectual languages, but individuals also differ from one another in the forms of these representations, their relative strengths, and the ways in which (and ease with which) these representations can be changed. (Veenema and Gardner, 1996). Multimedia encourages a richer and more accurate presentation and interpretation of what one has learned. Multimedia presentations are more engaging because they stimulate many senses at a time something many believe is essential when working with today's video and net generations (Jonassen, 1996). Preservice teachers have included video clips that demonstrate portfolio criteria, scanned copies of student work, and voices of children reading. In constructing multimedia portfolios, students are actively engaged in creating representations of their understandings and have a variety of tools to use to make that representation accurate and unique (Jonassen, 1996). Educators who compiled their own portfolios noted growth in their self-confidence, collegiality, and sense of personal empowerment (Wiedmer, 1998). Portfolios materialize as creative personal products that represent a formative and summative assessment of progress as well as a clear picture of creativity, organizational ability, and pedagogical knowledge.

Hypertext and Hypermedia

Normal text is linear, proceeding from beginning to end. Hypertext presents information in a nonlinear fashion, without a predetermined sequence. Barnes (p. 29, 1994) describes it as "interactive reading" because students experience the text as part of a network of navigable relations instead of a linear sequence of ideas. The reader finds the experience more personally meaningful because they have greater control over what is read and the sequence in which it is read. Its organization is not imposed by the author (Jonassen, 1996). Hypertext is more closely related to how the human mind operates, by association, snapping from one item to another creating trails of information, suggested by the association of these thoughts (Bush, 1945). Hypertext usually refers to an environment limited to textual jumps from one chunk of information to another. Hypermedia extends this concept to include additional forms of media that may be linked as well so that text may link to a bird's song or hear a student read. It may link to a video of a student teaching a lesson or a scanned image of a science test. The hypermedia component fosters connections between course work, concepts, and applications because it allows the individual to designate links between ideas and themes. It cultivates the development of association of content, theory, and practice helping students become thoughtful problem-solvers. Because the architecture of hypertext is open, the same set of data can be organized in many different ways to reflect different conceptual perspectives and orientations that facilitate the production of personalized products. One of the notable initiatives of the 1990's is the development of the World Wide Web. To those not familiar with a hypertext retrieval system, this may present a barrier (Barnes, 1994). As authors of a Hypermedia product, students become proficient hypermedia users in "a new kind of literacy prompted by jumps of intuition and association" (Heim, 1993, p.30) and a kind of literacy imperative for an educator to understand and demonstrate.

As a Mindtool

Jonassen (1996) describes mindtools as applications of computers in schools as tools for engaging learners in constructive, higher order thinking activities that help them become self-directed critical thinkers. In designing Hypermedia presentations, students are engaged in complex thinking skills and decision making: evaluating, analyzing, connecting, elaborating, synthesizing and imagining as they conceptualize and design their presentation. Adding hypertext capabilities creates another dimension of organization and interactivity, creativity, and complexity. Electronic Portfolios represent a challenging assignment that engages students in management, research skills, organization, presentation skills, and reflection. They select the multimedia tools they will use and essentially have *carte blanche* in representing what they know about teaching to faculty and potential employers. They must make numerous decisions about what to include, synthesize themes and help the viewer see their constructions. They use the technology to create: diversity and coherence, visual and textual balance, and stillness with movement. Learners are more mentally engaged in developing materials than by studying materials and the diversity of tools enables the student to express abstract concepts with concrete representations. According to Jonassen (1996, p.209), "...Hypermedia is the most compelling and potentially effective of all Mindtools" because of richness of representational forms available in designing with multimedia. The process of using this tool augments portfolio assessment by presenting a learning experience in itself.

Computer Literacy

In using electronic portfolios, students are demonstrating their ability to manage their information with a computer, and use some complex applications and sophisticated techniques to prepare their products. They work with different graphic file formats, import data from a variety of applications, perform screen dumps, scan and crop photos, digitize video, create slide shows, and insert sound. HyperStudio has built in hyperlogo scripting capabilities allowing students to include fairly sophisticated programming techniques. Students learn to correctly name and connect their files, save them to a server, disk, or CD-ROM, or e-mail as an attachment or upload them to the Internet. They use graphic tools, Internet resources, peripheral devices and constantly problem-solve using technology tools to produce tangible evidence of their ability to teach in twenty-first century classrooms.

Obstacles

There are some obstacles associated with electronic portfolio assessment to consider. Constructing any portfolio is a time-consuming process. Students begin with collecting and labeling artifacts, looking for patterns that express their educational philosophy and then need time to process these into coherent themes. It also takes time to translate all into an electronic format. Photos need to be scanned, videos digitized, and there is a limited amount of equipment available. Students attend to this assignment at the end of the semesters resulting in wait time for some equipment. Portfolios are also time consuming to grade and faculty have to know how to access these presentations and use hypermedia tools to understand the student's theme development and documentation. Although using a network can facilitate communication and exchange of documents, it can represent some interesting challenges in running software and saving files. Files get corrupted, the system crashes, and data is lost and retrieving and reconstructing it is not always possible.

One must have hardware capable of handling multimedia software with the ability to input and record sound and video. Lots of storage space is also advisable. Although students begin portfolios in their first year, they forget details and many need to work on them in a supported atmosphere and finally, although this is becoming less of an issue, there are still some schools that do not have the technology to view electronic portfolios.

Conclusion

New technologies have historically helped us do things better, and to do things not possible before. The printing press allowed books to reach the masses and cars enabled easier travel. Technology advancements in terms of the multimedia computer offer an assessment tool more aligned to accepted educational learning theory. Electronic portfolios can serve as an authentic assessment tool that provides a rich repository of information about teaching and learning. Electronic portfolio documentation using hypermedia software offers better management, storage, and distribution with the added value of providing a tool that promotes higher order thinking and creativity. Electronic portfolios offer a formative and summative assessment tool that simultaneously demonstrates technology skill. Putting the process of assessment in the hands of the student, portfolios produce tangible evidence of a student's ability to connect theory to practice and use new technology tools in the process.

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Development of a Personal Electronic Profile for Pre-service Teachers

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Abstract: As part of the pre-service teacher education program for the elementary and secondary education program at Northern State University, students were required to develop an electronic personal profile. The purpose of the project allowed pre-service teachers to become more proficient in the use of technology and also to communicate a personal profile to their future mentor teachers, K-12 students, and future employers using an electronic medium. The product they developed may also be included as part of their professional electronic portfolio.

Goals of the Project

During the past two years education faculty at Northern State University have emphasized the use of technology in the courses they teach and through the activities and projects required of pre-service teachers in completion of their program. With this project implemented as one part of their Instructional Technology class, students developed a personal profile of themselves using Microsoft PowerPoint as the software for producing the product. Microsoft PowerPoint was selected since it was most readily available for use by students in our computer labs and by the school districts in the regions they will practice teach.

The goals of the project were to:
1) Develop skills in the use of Microsoft PowerPoint in order to create classroom and professional presentations for their students and colleagues.
2) Create a presentation, which profiles information about their personal lives that reflect their interests, achievements, family, and community.
3) Enhance collaboration between pre-service teachers at Northern State University and K-12 teachers, students, and administrators.

Content Criteria of the Project

In order to communicate the requirements of the assignment, it was decided we would model them by creating a personal profile of ourselves for demonstration in our classes. We decided that even though each profile would be unique it should include minimum criteria and components.

The criteria we decided on should include:
1) A recent personal picture.
2) A favorite elementary or secondary school experience.
3) A memorable childhood experience.
4) A teacher or experience that inspired them to become a teacher.
5) A hobby or pet.

6) A unique or interesting fact about their community.
7) A personal achievement.
8) An interesting fact people would be surprised to learn about them.

Technology Components of the Project

Technology components and skills we wanted to have our students demonstrate through the creation of the portfolio included:

1. Producing an organized and motivating personal profile demonstrating appropriate visual, oral and written communication skills.
2. Utilizing a digital camera, computer scanner, and "Internet", to import and transfer pictures, music, sound effects, and graphics into their personal profile.
3. Creating "Internet Links" which will enhance the information presented in their profile.
4. Demonstration of equitable, ethical, and legal use of technology resources by following copyright regulations related to the use of electronic media.
5. Demonstration of these on Microsoft PowerPoint, which allows the use of a variety of texts, fonts, colors, layouts, sounds, images and special effects to create motivating and unique presentations.

Teaching the Lesson

Anticipatory Set

We introduced the lesson by stating the purpose, goals, and components of the project. It was suggested they create a storyboard which includes the texts, pictures, and special effects for each frame prior to creating the presentation. An example of the instructor's storyboard was distributed to the students.

Modeling the Lesson

We loaded our personal profiles and presented it to the class discussing various aspects included for each frame. This seemed to motivate the students and generated many questions.

Instructional Input and Guided Practice

We had each student load PowerPoint and they began to develop example frames using a variety of formats, texts, colors, sound and special effects as they were being demonstrated. A Microsoft PowerPoint Tutorial was distributed to students and reviewed to assist students in solving problems they might have while creating their portfolio.

Checking for Understanding of the Lesson

We had students practice by creating several frames implementing different presentation strategies. We answered their questions and demonstrated things that were confusing to the entire class or we had forgotten to cover during the instructional input stage.

Assessment of the Lesson

In order to assess the project we decided that we would create a rubric, which would include the criteria and the project technology components. The only additional requirements was that each student would also showcase the personal profile to the entire class during our *showcase day* and create a printout of the frames to be submitted with their CD ROM for grading purposes, see [Table 1].

Evaluation of the Project

Informal interviews with the students indicated the project was a very enjoyable and positive experience. Students were anxious to show them to their cooperating teachers and students during their field experiences. They also stated they planned to incorporate the electronic version in their professional electronic portfolio or the printout version in their paper professional portfolio. The only negative responses pertained to the significant amount of time required to locate personal pictures and Internet sites for pictures, music, and sound effects to create their presentations. As instructors, we found this to be a very successful and useful project for our pre-service teachers and plan to continue and refine the project during future semesters.

Personal Electronic Profile Rubric

- ☐ Introduction and conclusion frames with a recently scanned photo and e-mail address. (15 pts.)
- ☐ Elementary or secondary education experience that inspired you to become a teacher. (15 pts.)
- ☐ Enjoyable childhood experience with your family or friends. (15 pts.)
- ☐ Past or present hobby or pet. (15 pts.)
- ☐ A personal or professional achievement. (15 pts.)
- ☐ Experience which reflects your local community or home. (15 pts.)
- ☐ Internet links to sites, which enhance the information presented. (15 pts.)
- ☐ Use of sound, music, or animation. (15 pts.)
- ☐ Creative design, unique details, or interesting facts about you. (15 pts.)
- ☐ Presentation utilized correct grammar and is appropriate for your goals for your grade level audience. Includes a printout with rubric attached. (15 pts.)
- ☐ Total Points (150 pts. possible)

Table 1: Rubric distributed to students and utilized to evaluate their personal profile.

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Default User.com: Preparing Preservice Teachers for Constructivist Classrooms

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Abstract

The purpose of this article is to present a model for integration of technology into teacher preparation. A four-course block of elementary teacher certification courses serves as the context for this study, as well as a university-based summer camp for the requisite field experience component. Investigators analyzed purposes for technology integration into the curriculum of the methods courses and the students' use of technology in the field experience as they worked with children ages 6-11.

In his 1997 State of the Union Address, President Clinton issued a "Call to Action" that included as a priority improvement of the quality of teachers in every American classroom. President Clinton's speech reflects the rhetoric of concern over the condition of education and the nation's need for excellent teachers. The nation requires teachers with the knowledge, information, and skills necessary to prepare students to live and compete in a complex international marketplace. This means, students must be knowledgeable in a broad base of disciplines, technologically literate, and autonomous learners.

Definitions of good teaching range from those that focus on what should be taught and how knowledge should be imparted to the kinds of knowledge and training teachers should possess. Two broad elements emerge as characterizations of teacher quality: (1) teacher preparation and qualifications, and (2) teaching practices. The first refers to preservice learning and continued learning. The second refers to the actual behaviors and practices that teachers exhibit in their classrooms (U.S. Department of Education, 1996a). These elements of teacher quality are not independent; excellent teacher preparation and qualifications should lead to exemplary teaching behaviors and practices.

Using a nationally representative survey of full-time public school teachers of core subjects or self-contained classroom, the National Center of Educational Statistics (NCES) (1999) included indicators of preservice and continued learning (e.g., degrees held, certification, teaching assignment, professional development opportunities, and collaboration with other teachers). The survey indicated that currently less than half of American teachers report feeling "very well prepared" to meet some classroom challenges, specifically feeling 'very well equipped' to integrate technology into classroom instruction (20 percent). White (1996) advocates that technology can facilitate preservice teacher understanding of and engagement with problem solving and critical thinking skills facilitating their development of desired teaching behaviors and practices.

We teach how we're taught. In this era of constructivism, preservice teachers continue to enter teacher education with the belief that teaching is all about the transmission of knowledge rather than interaction and construction of knowledge (Brazee & Kristo, 1986, Shor & Friere, 1987). As undergraduates, they attend 'lectures' and respond to tests about these lectures in their core requirement classes. They encourage their teacher training supervisors to observe them on days when they're really 'teaching' (lecturing) rather than those days where students are actively involved with activities of a constructivist nature. They don't perceive these strategies as teaching, limiting their ability to spark fresh insights in their own students (Holt-Reynolds, 1991). Field experience is carefully guarded as a special event rather than an integral component of teacher preparation. Use of technology is covered via stand

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alone courses that are taken out of the context of teaching and with the leap of faith that it will be accommodated into the daily life of the student. Is there any reason to believe that preservice teachers can be prepared to create constructivist classrooms that prepare their students to live in a complex international marketplace carrying with them this nonconstructivist experience?

To develop technology-using teachers, preservice teachers must experience demonstrations by their professors, integration of technology into daily activities, and application of technology into their class projects and field experiences. Technology also supports the reflective practice essential to the development of a constructivist teacher (White, 1996). Camp Paw Print was developed as a constructivist field experience requiring the use of daily interactions with technology through the preservice teachers' own instructional experience, as well as their planning and preparation for the camp.

Methodology

This paper reports the outcomes of the preservice elementary methods students taking a block of courses that were richly infused with technology as tools of instruction and communication and integrated into the context of science, mathematics, social studies, and language arts content and pedagogy. The culminating field experience gave rise to observations, measurements, and analyses of these preservice students as to their abilities to use various types of technology. The role that technology took in their of instruction of children ages 6 to 11 years and the way that they learned to use technology in instruction was significantly increased from the limited impact of the stand-alone course previously taken as a core requirement.

Observational data was recorded through anecdotal record by preservice teachers regarding each child's interactions with the instructional materials, other children, and the ability of each child to meet instructional objectives. Graduate students collected observational data through the course of the summer semester about preservice teacher level of technological literacy. Professors of the methods courses collected observational data on preservice teachers during the camp regarding their planning of integrated, content-rich and technologically supported experiences and implementation of instructional plans, their interactions with the children, and their ability to problem solve events and situations that emerged. The graduate students and one of the professors kept Field Notes of the camp that were analyzed for significant patterns in technology use and implementation and authenticity of application.

Interview data were collected by the graduate students from SHSU methods' students regarding their understanding of the events of the camp/field experience and their beliefs about the use of technology. Student products were collected daily by the children and reviewed with the children by the preservice teachers for evidence of the child's having met the instructional objectives.

Methods students and campers participated in pre and post test technology attitude surveys that were analyzed by the graduate students.

Each preservice instructional team prepared daily assignments for themselves regarding who would carry out instructional duties, who would provide support, who would be taking the camper kid-watching notes for the day, and who would record through digital video or still pictures the events at the center and/or computer laboratory.

Graduate students and professors analyzed the threaded message boards used by preservice teachers and children for type of response, reflective nature, and cognitive connections between instruction and life experience. Follow-up data regarding use of technology during student teaching, feeling of preparedness to student teach, and unfulfilled plans for instructional strategies in their first position as teacher were collected from preservice teachers during a Camp Paw Print reunion during their student teaching semester.

Findings

Modeling Technology Use for Instruction

Integrating technology into the day to day instruction of the methods courses was important in the overall modeling of technology as an instructional tool. Threaded message boards were used by students to respond to their reading assignments. Each student was required to respond to the reading assignment with a question about the reading, a quote from the reading, and a comment about the thrust of the chapter. They were required to respond to at least two of their colleagues' postings and to everyone who responded to them. Other uses of the threaded message boards included the posting of responses to current issues in education or demonstration video-tape/video disc of classrooms. Posting of products, such as lesson plans or unit outlines, allowed all students in the class to review each students work and their approach to a given topic. Students commented that they took greater care with the content and composition of their responses when realized that the other students and their professors would be regularly reviewing their work and responding to what ideas they had put forward.

Other uses of technology were the use of web pages that were developed to support daily lessons and the course. Daily lesson pages included links to threaded message boards that students would respond to after participating in a class activity, links to web sites that offered supporting material to the lesson, and links to common pages that contained planning in progress for the field experience camp, Camp Paw Print. Course support web pages included the syllabus, e-mail links to all members of the class, an announcements page, links to support to the course (e.g., lesson plan pages, professional organizations, Texas Education Agency, State Board of Educator Certification). These web sites contained a schedule for each day and the topics of discussion, including the reading assignments. Students could access the course support pages from their homes if they were absent from class and work on the materials that would be due when they returned or to see what changes might have been arranged. In addition the sites included links to questions for discussion and instructions for classroom activities. Sites also included links to children's books on line or reader's theatre scripts. These sites were used as sources of children's literature for classroom study. In addition, literacy events were constructed around web sites that contained content related to the upcoming field-based thematic-unit of study—Hawaii.

E-mail was the official method of contact between students and professors, and all students in the course were required to correspond with their professors and their team members in this way. Each student had a campus computer system address, but could use their home e-mail address if they desired. Professors accessed e-mail often and were able to respond to messages frequently. This approach was much more consistent and responsive than telephone calls.

Integration of Technology into Preservice Teachers Field Experience Lessons

During the field-based learning experience, Camp Paw Print, preservice teachers were required to integrate technology into their lesson plans. Before their participation in technology-enhanced methods, students greeted this requirement less than enthusiastically and in some case with hostility. They felt underprepared and overburdened for this requirement. However, as the short, summer semester progressed, and students became more adjusted to responding to their reading assignments on threaded message boards, reading and responding to their classmates' work, checking the course web site for the daily schedule and related resources and activities, they became less vociferous in their complaints. By the time, they began teaching, they had put up web pages for their teaching teams with links to their own lessons and resources. They were comfortable and proud of this technology-resources, and many students voiced their opinion that they would not want to teach without access to the 'net.

Preservice teachers integrated technology into their lessons for the following purposes:

- Building Community and Getting Acquainted
- Creating Environment
- Investigation
- Activating Existing Schema and Creating Prior Knowledge
- Inquiry
- Applying Concepts
- Connecting to Culture
- Modeling
- Responding to Literature
- Dialoguing with Experts or a Virtual Community of Learners

Building Community and Getting Acquainted

Preservice teachers used technology to get acquainted with students and build a sense of classroom community. A graduate student intern set up threaded message boards, and preservice teachers created questionnaires for campers to respond to on-line. Campers typed out the answers to the questions—sometimes on their own, or with the help of the preservice teachers, and mini biographies of each students' background and interest became available to campers, preservice teachers' and professors. In this way, technology was used as a literacy event, a team building activity, and as a way to create community.

Creating Environment

Technology was also integrated into the classroom environment to set mood and tone and contribute to a cultural understanding of the environment being studied. Pictures of Hawaii were projected through a computer-enhanced projection unit to give a display Hawaiian land, sea, and beach landscapes and create a scenic effect of being in Hawaii. In addition, digital pictures from Hawaii were captured from the web and put in a Power Point slide show presentation which was then used in a "look out the window" flight simulation for campers' who participating in a flight simulation from the mainland to Hawaii. Once again, the pictures helped support an understanding of what the journey would be like as well as what the experience of flight was.

Investigation

The science center became the focus of several technologically enhanced lessons. One lesson in particular used the web as a resource of information for the scientific principles that support flight. Preservice teachers created a web site that utilized the nonlinear nature of hypertext to allow a camper to create an investigation of flight. Campers were to select an icon of an airplane to learn about flight, then could select one of several entry points to learn about the kinds of flight and principles of flight. Students then created their own objects to fly and experimented first hands with the principles of flight by trying to fly their objects.

Activating Schema and Creating Prior Knowledge

For a literacy event, preservice teachers used the web as a resource for students to learn about volcanoes prior to campers reading the book Dear Katie, The Volcano is a Girl by Jean Craighead George. To prepare for the reading, campers filled out KWL charts, listing what they knew about volcanoes prior to viewing the web site and what they wanted to know about volcanoes. Campers then viewed http://volcano.und.nodak.edu/, a web-based volcano site. They returned to their KWL charts to write what they learned about volcanoes after viewing the web site and then with their prior schema activated and/or new schema created, they read the story, Dear Katie, The Volcano is a Girl.

Inquiry

Preservice teachers developed an Internet-based inquiry lesson on Hawaiian animals. Campers worked with partners and/or a preservice teacher to explore the site to finding information on the kinds of animals that live in Hawaii, where they live in Hawaii, what foods they eat, and the classification to which they belong/ (mammal, bird, reptile, etc. and why) This information was charted by teams and brought back to group discussion and hands-on activities.

Applying Concepts

Preservice teachers developed a problems-based math lesson in which campers would use hands on activities and web sites in order to understand the relationships between shapes and mathematical language. Preservice teachers displayed various triangular figures and elicited camper response about the properties of these shapes (3 sides, 3 corners, angle, straight rather than curved.) Then distributed pattern blocks to each students. Then had students explore ways to make triangles with the pattern blocks. Then students went to the Internet to "build triangles" on a tessellation site (http://www.forum.swarthmore.edu/sum95/suzanne/active.html)

Connecting to the Culture

In order to relate to the sounds and rhythm of the Hawaiian language, students went to a web site and entered their name. The site contained a translator program that translated the American names into the Hawaiian equivalent. Students then displayed their Hawaiian names beneath their American names on their name tags.

Modeling

After studying and Internet-based lesson on states and their flags, preservice teachers used the Internet to have campers research information about symbols in general. After some discussion, each camper chose a flower as their symbol, and then they printed pictures of flowers and then took them back to the Social Studies center and drew their own rendition of the flowers. In addition, students viewed Hawaiian children hula dancing from video and then followed the video teacher's instructions and learned to hula along with the video.

Responding/Dialoguing

Threaded message boards were used for campers to write responses to literature they studied. In addition, they used e-mail to contact experts in areas they were researching.

Conclusions and Implications

Preservice teachers arrived in the summer methods block with varied computer skill and lukewarm attitudes about the use of technology. Most of them had experienced the use of e-mail. A number of students knew they had e-mail addresses, but couldn't remember the predictable username or password that they had been assigned when they had taken the required computer science course. Some were known only as default user.edu when they could not recall how to set the preferences for their account. And, a few students were quite fluent with e-mail and Internet use. It was evident that the knowledge and application of the requisite stand-alone computer science course had not developed expected schema for the preservice teachers.

None of the students had experience in developing web-based instructional materials or participating in threaded-message boards as an integral part of class. The preservice teachers were able to develop their own threaded message boards to review student writing and explanations at the literacy center. While type of technology to be used during the camp was not defined, the preservice teaching teams were all able to incorporate instructional technology on a daily basis. A problem that developed early in the camp program was the need to schedule specific times for various computer stations for each center so that all teams and children could have the access they desired. The types of technology that the preservice teachers wrote into their plans was the technology that had been modeled and used consistently during the methods courses.

Children typically wrote more on the threaded message boards and expressed greater interest in the reading of responses of their peers in this medium. The parents of the children requested URL's for the writing sites to view their child's writings and responses. The campers' interviews and attitude surveys revealed high interest in working with technology and increased time on task for content projects enhanced with technology. In addition, critical thinking was regularly employed in the context of problem solving, and the use of technology was a significant factor in providing information resources for analysis, and a means of graphically organizing their products. Campers and students reported an appreciation for being able to print out resources for home use, and an appreciation for the aesthetics of their own final products which were printed or displayed through a light projection unit.

Preservice teacher development was significantly more learner-centered than in those field experiences where the preservice teacher worked in an established classroom. The preservice teachers had to work collaboratively to develop much more of the operating procedures, curriculum, and supervision infrastructure than the traditional field experience students. This group of preservice teachers than in typical sections of methods block expressed a stronger camaraderie.

Seven of the twenty-five preservice teachers gathered for a reunion in October of 1999, the fall semester following their field experience. They expressed a strong appreciation for their methods and field experiences, particularly in the areas of collaboration, classroom management, and integration of technology in curriculum The seven students were teaching in four different school districts, and each reported that technology was not typically being integrated into classroom curriculum. All seven of the preservice teachers indicated their mentor teachers had expressed interest in learning technical skills from them with software and basic computer skills. Two of the preservice teachers had mentors that used a computer inside the classroom for record keeping. The preservice teachers reported that their own technology expertise had increased as a result of the constant integration of technology into their methods' block, and that after using it in field experience, it was an easy transition to use it in their student teacher placement. They felt disappointed that more technology equipment was not accessible to them in public schools.

Implications

Technology-enhanced instruction should be regularly integrated into preservice teachers coursework, both in the College of Education and the College of Arts and Sciences.

Technology-enhanced instruction should incorporate the same features that make technology useful into today's world—collaboration, rapid access to information, ability to input information and disseminate quickly, global connectedness.

Field experiences must offer an opportunity for preservice teachers to integrate technology as well as pedagogy which is consistent with current real world experience.

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Computer-Mediated Communication, The Infosphere and the Virtual Learning Community

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Abstract: The Infosphere represents a global resource that can be applied to the teaching/learning environment and utilizes the computer as a mediator of communication. How can such resources be incorporated into the classroom? What are the effects of computer-mediated communication on the teaching and learning processes. How do students and teachers react to computer-mediated communication. This paper begins the process of understanding the effects of technology on communication by examining student and pre-service teachers reactions to the use of computer-mediated communication.

Problem/Concept

Presently myriad opportunities exist for educators to utilize technology to support teaching and learning. Typically these opportunities are presented as pieces in a puzzle and not integrated into the whole school/curricula culture. Yet, schools exist within an increasingly global culture--one that is united by new technologies, transported by the Internet and the World Wide Web. Computer-mediated communication through its ability to access global information makes possible a new and potentially more unified culture. Dr. Boris Berenfield, metaphorically describes this culture as the Infosphere "[implying] the growing unity, interdependence, and accessibility of information produced by humankind" (Berenfeld, 1996) and encompassing technological and informational resources. How does the Infosphere change the nature of how students find, access, analyze process and exchange information? How can the Infosphere change the nature of how we teach and learn? How does the Infosphere change what we understand about teaching and learning?

This paper describes a beginning, the application of Infosphere resources to the teaching/learning process and the way in which students and pre-service teachers react to the process. The project was concerned with:

- Determining the impact of educational-oriented computer-mediated communication on student attitudes toward technology?
- Determining the impact of computer-mediated communication on student attitudes towards communication and collaboration?

Theoretical Basis

Vygotsky believes that "culture is the product of social life and human social activity" (1986, p.168). Michel Foucault addresses this issue of culture in the context of discourse. He believes that learners create knowledge with language, and, while solving open-ended problems, they are created as thinkers by the language they use within a particular discourse (1971). Traditionally education has been representative of its geographic social, political and cultural environs. Also traditionally education has assumed there is a fixed body of knowledge which can be transmitted from educators to learners. But in Infosphere, knowledge is transmitted, analyzed, and in many cases, transmuted so quickly that it is continually evolving. No longer, can knowledge be

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thought to be a static entity dispensed by educators. Instead now, many educators believe that thinking takes place in communication, in an act of knowing in which the learner assumes the role of knowing subject in dialogue with the educator" (Freire, 1988, p.403-404).

With computer-mediated communication, an opportunity exists to open the boundaries of classroom communities whose discourse is not limited by time or space, or by the tradition of a fixed body of knowledge. Words become tools, in this medium, and this helps accomplish the work of learning—mobilization of thinking. Furthermore, Banks posits that when thinking takes place in communication, and that when learners' home cultures are honored and validated, a dialogue will open up fixed boundaries so that "students can freely examine different types of knowledge in a democratic classroom where they can freely examine their perspectives and moral commitments" (Banks, 1993, p.6).

Educators using CMC have an opportunity to situate their curriculums in the context of real life problems. They use collaboration between students, educators, and professionals in a variety of disciplines, and they utilize a wealth of informational resources, none of which are limited by geographical time/space boundaries. Educators who use language to mediate problem solving through the Infosphere have the ability to not only supply information through technological means but also the potential to impact the culture-- the values, ideologies and social context of the populations they serve. The Infosphere resides in and informs that social context.

Methodology

In the summer of 1999, 24 students enrolled in a block of elementary methods' courses. The students were involved in a five-week project designing and implementing Camp Pawprint, a summer camp for elementary school children. The project consisted of the development of curriculum, lesson plans and teaching materials centered on a Hawaiian theme. The students were expected to integrate technology into the curriculum design and also utilize technology as a management and development tool. Much of the material was developed using standard office applications. The worldwide web was utilized as a major data and image resource and both email and threaded message boards were used to communicate among students and between faculty facilitators and the methods students.

Once the curriculum and materials were prepared, the students acted as facilitators in the summer camp. During the methods course and the summer camp both quantitative and qualitative data was gathered, including:

1. Computer-mediated communication, primarily in the form of threaded message boards used as a medium for discourse in the learning/teaching process. The threaded message board provided the opportunity for sequenced multimedia communication in both asynchronous and semi-synchronous modes. The content and structure of communication through the threaded message boards was be analyzed to ascertain how the process impacts both learning and teaching. The threaded message boards provided data from both the methods course pre-service teachers and the Camp Pawprint attendees.
2. Pre-post surveys of methods student and camper participant attitudes toward technology. The analysis of these surveys was used to identify changes in attitudes as a result of exposure to learning-oriented, computer-mediated communication. Pre-post surveys of methods student and camper participant attitudes toward technology were used to identify changes in attitudes as a result of exposure to learning-oriented, computer-mediated communication. The results were discussed in the evaluative narrative and then the resulting attitude data was mapped to the perception data.

Analysis

Data was collected from 12 students enrolled in EED 560, elementary teaching methods and SED 560, secondary teaching methods. In addition data was collected from 24 elementary school students enrolled in Camp Pawprint. The generation of 1747 messages in 29 message boards used by 38 users. The average length of message was approximately 67 words with the longest messages being initial postings (new questions of items for discussion) and responses being somewhat shorted. The graph below illustrates the distribution of message length.

The messages boards used by the methods students had a life of about eight weeks, those used by camp Pawprint, about two weeks. Threads within each message board had duration of about 5 days with an average 8 hours between postings.

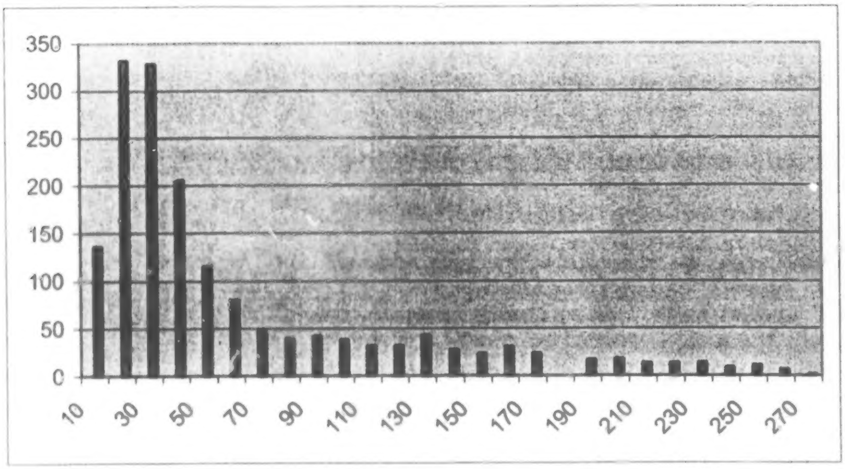

Figure 1: Distribution of message lengths

Message Board Content Analysis

Threaded message boards served multiple instructional purposes in the Spring 1999 Secondary Methods Block which was taught as a Distance Education Course via the web. They provided a mechanism for the professors and students to:

- Organize information about the structure and content of lessons
- Post expository assignments discussing the application of theory to classroom practice
- Report primary data collected
- Post lesson plans and construct instructional strategies
- Summarize and reflect upon assigned readings from texts and journals
- Evaluate textbooks & class assignments
- Participate in book club discussions
- Present persuasive arguments on educational issues
- Analyze educational issues and current events
- Simulate classroom practices through role-play, etc.

The professors for the methods-on-line class published web pages to deliver information about the structure and content of the course, but the threaded message boards became the forum for students to interact with the professors and other students in the class. In a typical lesson, a professor posted:

- General information, which consisted of the dates and times the assignments were due for any particular class meeting
- Questions which guided student inquiry into the lesson
- Introduction into the topic, which provided a basis for linking student prior knowledge to the topic to be studied
- Threaded message boards for students to respond to the readings and discuss their responses with each other or post other instructional activities

Attitudinal Analysis

An instrument designed to measure attitudes toward computing (Cooper, 1997) was administered to the students enrolled in the Elementary and Secondary methods courses at the beginning of the course and at the end of camp Pawprint. The instrument evaluated student responses within the framework of Bloom's (1956) taxonomy of educational objectives (Affective Domain). The instrument provided data on five aspects of affective response:

- Receiving (items 6, 19, 25, 26)
- Responding (items 13, 19, 22, 27)
- Valuing (items 2, 5, 8, 12,21, 24, 25)
- Organizing (items 3, 7, 8, 10, 11, 14, 16, 18, 20)
- Personal (items 1, 4, 6, 8, 16, 13)

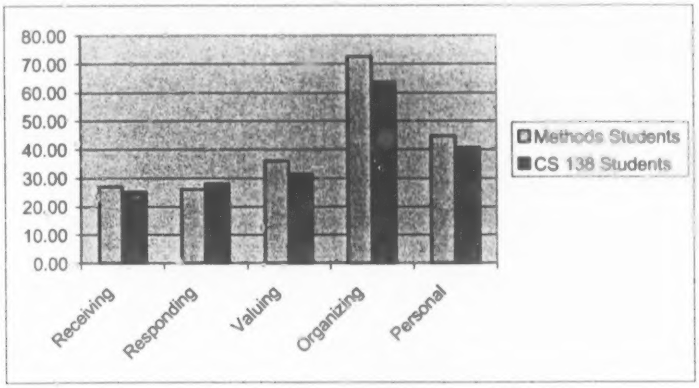

Figure 2: Methods Students Attitudes toward Computing

With only 12 respondents in the sample, it was not possible to perform a statistical comparison between the pre and past data. However there did not appear to be any major differences between the pre and post scores. A comparison was made between the post scores for the Methods course students and data previously collected for CS 138 students, students enrolled in the freshman general education computing course. While no statistical results could be obtained due to the nature of the instrument, it does appear that the Methods students had a more positive attitude toward computing as measured on four of the five subscales.

An instrument measuring affective response to computers was administered to the camp Pawprint students before and after the camp. The instrument measured positive and negative attitudes. Comparison of pre (top bar) and post (lower bar) responses are shown below.

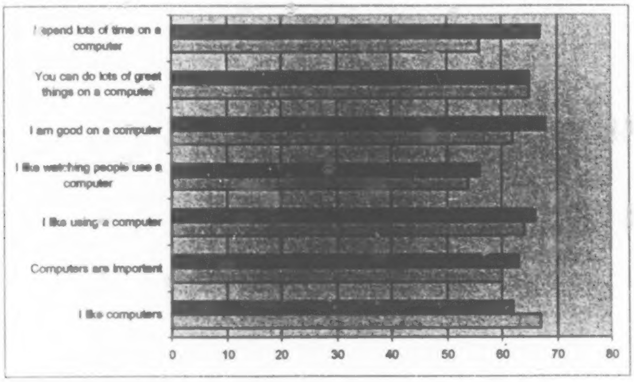

Figure 3: Pawprint Students, positive attitudes

Again, while no statistical analysis can be performed it appears that while the positive attitudes were somewhat lower after the camp, there were more marked reductions in the negative attitudes displayed by camp Pawprint students.

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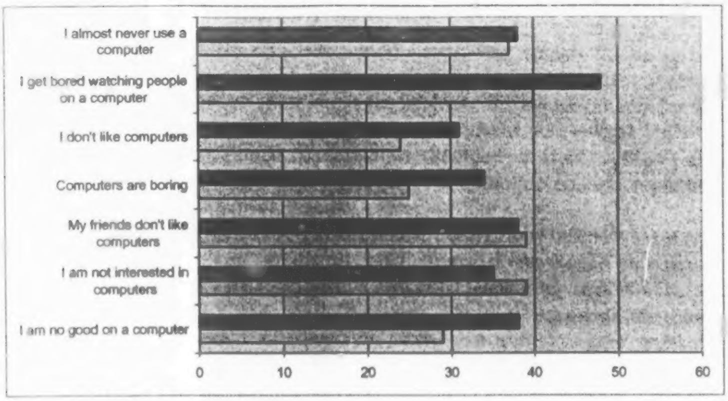

Figure 4: Camp Pawprint. Negative attitudes

Conclusions and Implications

How does the Infosphere change the nature of how students find, access, analyze process and exchange information? How can the Infosphere change the nature of how we teah and learn? How does the Infosphere change what we understand about teaching and learning?

The Infosphere can be the nexus of thought and language that teaching and learning occurs. Threaded message boards offer these points of connection in public space. In this setting of the Infosphere students find, access, analyze, process, and exchange information.

Teaching and learning is changed by the way students and professors participate in a cyber class. Students can not sit passively and observe discussion, but rather must be active participants in the discussion. They must be ready to defend their work with logical and rational reason, and they are exposed to ways educators react to a given problem in multiple educational contexts:

- Professors must design and organize the course around real problems that connect course content to student schema in a meaningful ways. The professors' roles should be that of orchestra director and facilitator—participating in the on-line community's conversations by questioning, extending, and challenging.
- Students engagement in the course is enhanced through interaction with the text and lesson assignments and responding electronically to what colleagues and the professors post on the threaded message boards.

Threaded message boards provide public space for students' publishing their understandings of educational theory and practice. Their work is not limited to being acted on by the instructor; rather, they must be ready to defend their work to their colleagues. Primary research can be disseminated more rapidly by being published on the threaded message boards thus increasing the impact of the research.

Threaded message boards provide a public forum to publish lesson plans to an audience of their peers. The public nature of this forum increases student accountability extending it beyond the scope of classroom practice and the evaluations of their instructors. Cyber book club discussions posted on the threaded message boards open boundaries of traditional teacher-directed assignments, allowing students to discuss books an pertinent issues in a manner consistent with real world dialogue. Threaded message boards offered a public space for analysis of events in popular culture, which affect education and society. Students can offer reasons and pose solutions to current dilemmas and reality check them against their peers' understanding of society and the values. Threaded message boards offered a medium for role play and simulation. In this medium, students could enact how they would respond to an educational problem and then view how their colleagues might respond.

Preliminary results indicate that a majority of students' attitudes toward technology were positively influenced over the course of the semester after a period of initial resistance. Communication and collaboration between university students, university students and professors, and campers increased beyond the traditional classroom boundaries as a result of participation in computer-mediated communication.

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Cold Computers and Warm Hearts:
Using Group Process Techniques to Facilitate the Development of Educational Technology Skills While Conducting Pre-Service and In-service Training

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Abstract: Individuals who select teaching as a profession tend to be high on the scale of incorporating personal interaction into learning situations. They are usually people-focused with less interest in machines. Computers, on the other hand, offer an isolated, somewhat sterile environment in which the individual is learning techniques that are quite different from his/her educational experiences in the past. It seems, therefore, an oxymoron to expect teachers to work alone as they attempt to learn how to use teaching technology tools. Integrating a group process-oriented pre-service or in-service experience with mastering computer technology skills builds upon the very strength most teachers bring to the profession.

Introduction

According to a study published in 1999 by the U.S. Department of Education, only 20% of teachers considered themselves well prepared to integrate technology and learning in the classroom. Ellsworth in a 1997 publication suggested that universities are failing to provide adequate technology training, particularly in the area of using the internet, for students who plan to become teachers. The need for experienced teachers to keep up with advances in technology through in-service training has also been discussed by authors such as Melheim (1997)..

The complications involved, however, in increasing the percentage of teachers who feel prepared to use technology in the classrooms are many. Of major importance in determining in-service training needs is the assessment of skill and knowledge levels, either through asking the teacher to complete a needs assessment, or via another variety assessment such as a discussion group meeting with faculty and the prospective group facilitators.

Levels of Technology Skills and Knowledge

Differences in understanding and skill levels vary greatly among faculty, ranging from never having touched a computer to sophisticated knowledge of the use of complicated multimedia systems. Levels of accomplishment, however, may be grouped according to the following system:

> Teacher understands computers, how they work, basic operating systems, and peripherals.
> Teacher knows about other learning experiences available through computer technology and software including the internet, distance learning, using a PDA, as well as other technological information systems.
> The teacher is able to match the learning needs of the students to available technology.
> Teacher knows how to use software, knows what is available in their area of teaching, is able to integrate material seamlessly into classroom teaching in a manner that supports and enriches the curriculum.
> Teacher is aware of the student's role in using technology in a creative way as part of both their group and individual learning projects.

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Basic computer skills including understanding the computer operating system, how to use folders and files, word processing, spread sheets and data basis are generally taught in most educational institutions. These competencies are expected of beginning teachers. Knowledge and skills in these areas are often an important criteria for hiring in many school systems. Teachers who have been part of the system for several years, however, may not have had the same educational opportunities provided in most colleges and universities today, and therefore may need to catch up with their younger cohorts regarding basic computer use and even more sophisticated skills.

The expectation that experienced teachers learn advanced skills implies the anticipation for changes in instructional strategies developed throughout years of teaching experience. The resistance to learning computer technology may well be partly due to this realistic concern.

For other teachers who have mastered the basics of computer technology, the added pressure of in-service training in more complex areas, particularly those having to do with the successful integration of technology with curriculum and student needs, may be threatening as well.

Finally, the time needed to carry a full time teaching workload along with the expectation that the teacher acquire or refine computer or other technological skills may be overwhelming to the busy teacher.

It seems reasonable, therefore, that various incentives be available to those who are willing to update their technology skills. These might include bonus pay, an extra hour per week of prep time, paid in-service workshop opportunities either within the system or in the community, and of course ESUs needed for teacher certification.

The Value of Group Process in the Learning Situation

Teaching skills or specific informational areas in groups is the cornerstone of most school systems. Whether called classes, seminars, workshops, or any other name that implies people getting together to accomplish a specific task, groups of students are generally brought together to engage in the learning exercise. When a teacher or facilitator receives training in a certain area, he or she is much more likely to feel prepared to use the information and skills acquired during the training. If properly done, the teacher may even feel a sense of excitement regarding a new strategy for instruction. Kelly, in a 1999 article, described how a teacher training session on Microsoft's PowerPoint was instrumental in her developing an approach to teaching students to use a presentation program for their own work.

The group process, however, is often devaluated or ignored in learning situations. Content rather than process is stressed, thereby losing the advantage of one of the most productive aspects of partnership in groups. It is my contention, therefore, that the integration of group process theory with content by a facilitator with experience in dealing with group dynamics, would enrich the learning experience for most participants. Johnson et al., (1987), while discussing the research of Lewin , (1951) states: "His research demonstrated that learning is achieved more productively in groups whose members can interact and then reflect on their mutual experiences." Such emphasis on group process during the course of a computer technology workshop or seminar has the potential to improve the group's learning experience by:

Openly addressing resistance to learning
Developing a trusting, helping atmosphere in the learning situation,
Forming bonds that would continue to provide a source of help, even after the seminar is over.
Extending leadership opportunities to all group members according to their knowledge and skills related to the subject at hand.

With these advantages in mind, the logistics of group process as integrated into this specific learning experience will be explored.

The Pre-Group Planning Stage

The concept of group stages or phases and the group processes involved in each stage has been embraced by many writers and researchers. The pre-group phase, group planning and formation, is devoted to the development of goals and objectives and their integration with the skill levels of the participants for whom the group is planned. As Toseland et al., (1997) suggest, during the planning stage, the group leader focuses on both the task to be accomplished and the level of knowledge and skills of the potential participants. Is the workshop to be devoted to learning basic computer skills, more complex technological strategies, or something in between? The answer to these questions lies both in the targeted membership population as well as the knowledge and skills of the facilitator of the workshop or seminar.

The next step is acquiring information regarding the targeted audience. Is there a need for teachers who have been in the system for many years to catch up or even begin learning basic computer skills? Does the school system have several new teachers who have mastered the basics of computer use, software, and internet use, but who are unsure as to how to assimilate these areas of knowledge and skills into the curriculum they are expected to teach? Or would the school system administrators rather group the participants according to curriculum areas rather than skill attainment? Answers to these questions having to do with group formation will determine the number of groups needed as well as the information and practice that should be provided. As was stated previously, information may be obtained though needs assessment questionnaires returned by faculty members several weeks prior to an in-service training session, or, when possible, through meetings of the faculty of a specific school or district.

Preplanning has been completed when: the workshops have been organized during times convenient to a sufficient number of participants; the grouping of appropriate skill levels concluded; an appropriate number in each group has been selected; and the availability of adequate technology teaching resources has been assessed.

Group Stages and the Learning Process

When a group actually begins, the first stage of group process is an orientation to the purpose and goals of the group as well as a "getting to know you" opportunity. During this early stage in the process of a short term group, it is common for participants to be uncertain as to what will be expected of them, what kind of behavior they will experience from other group members as well as the paradox of impatience and hesitance (Corey et al., 1997). The activities of group members as they become acquainted and learn to trust each other, although somewhat time consuming and often disparaged by group members themselves, pays off later when the need arises for trust and cooperation rather than competition or judgmental behavior. This is particularly true when one of the goals of the group is to help the members work together both inside and outside of the group to improve their skills and share their experiences in building technology strategies for their classes. One group activity usually found to be successful in helping members get to know each other consists of asking the group members to form dyads with someone they do not know well, with the purpose of interviewing the person regarding their technology skills, and then introducing them to the rest of the group members. Another exercise that also works well involves each group participant standing behind his or her own chair, playing the role of a relative or close friend who would relate details about themselves (the group member) that would be important to the task at hand. These activities work best when the group facilitator starts the exercise, illustrating both the logistics and the information about the participant that would be most helpful in the learning situation.

During this initial stage, and also during a second stage sometimes classified as a stage where differences are worked out, the group considers whether the goals of the group fit their needs, and interests. These considerations often have to do with inclusion/exclusion, that is, each member contemplates whether or not this group will meet his or her needs. As this occurs, care must be taken by the learning group facilitator to help those who feel they must exclude themselves to either find a more suitable group, or to reassess their abilities to learn the material to be presented. A clear understanding of the skills that will be taught and the expectations in terms of time and achievement will often help those who feel initially overwhelmed by the experience to stay with the group. On the other hand, understanding the purpose and scope of group goals will be helpful to the potential participant for whom the information would not be useful, or would be redundant because of the technology knowledge and skills group the member already possesses.

Once the member configuration of the group is established, the goals and expectations clearly explained, and the participants relatively comfortable with each other, the group is ready to work. At this point, it is helpful to attempt to match those who seem to catch on more quickly or have more beginning skills with those who are more hesitant to try something new or ask questions of the facilitator. Hopefully, the setting for the workshop would be a computer lab with availability of a well-maintained computer for all participants. As the workshop continues and the facilitator gets to know the abilities of the participants more fully, the buddy system suggested above can easily be inaugurated with a change of seating arrangements. In an ideal situation, several facilitators per workshop would be available so that questions and problems could be solved more quickly, consequently keeping the group together in their skill development as well.

As the learning group moves toward a more trusting and cohesive level, each member will be more willing to ask questions, even those that may seem "stupid" or embarrassing. Since members have learned to know each other well enough to be aware that they are each nearly the same stage in the learning process, much less competition or threat of being seen as inadequate will be present in the group. The group members will have had an opportunity to observe the leader's behavior as well. As they experience the technical skill of the leader as well as his\her warmth and interest in each participant, the group members will be more likely to ask questions of the facilitator, no matter how simplistic or elementary the questions may seem to the participant.

As the workshop is drawing to a close, emphasis on the future will be part of the natural progression toward group termination. A review of the material covered and how it might be used by the participant either personally or in the classroom would be indicated. The need to practice that which was learned should also be accentuated. Facilitators must emphasize that practice should begin as soon as possible, since new ideas and skills may quickly be forgotten as the participants focus on other aspects of teaching when the workshop experience is over.

The possibility of getting together informally with the group or several members of the group after the workshop for socialization is often a pleasant ending to the experience. Group members being available to each other, and the availability of the facilitators through offering continued aid for questions or problem resolution (particularly if they are part of the staff of the school system of the participants) could provide an excellent continuing resource for those who attended the workshop. The possibility of another in-service training opportunity might be discussed as well, focusing on perceived needs in the present, or more complex issues anticipated in the future. Finally, a questionnaire, assessing the value of various areas of the experience should be distributed and completed by participants as part of the workshop.

Using the group process as a teaching tool to "warm up" the technology experience requires that the group facilitators be trained in the knowledge and skills needed to lead small groups as well as the technology skills needed to fulfill the goals of the workshop. Even though these facilitating skills may require extensive knowledge and training in various domains, some of which may seem unrelated, the enrichment provided by the technology learning experience combined with the relationships developed during the group experience has the potential to provide major rewards for both participants and group facilitators.

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Enriching Preservice Field Experience Through Email Mentoring

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Abstract: This study focuses on ways to connect field experiences to academic theory and reflection through email correspondence. The assignments given by the university instructor were designed to facilitate the students' reflections on observations in the classroom. The instructor hoped that her responses would mentor the students to be reflective about their observations.

Introduction

Feiman-Nemser and Buchmann (1989) report that students come to their education courses with the belief that academic theory and reflection have no relevance to becoming a teacher, and that experience in the classroom will be the primary source of growth in becoming a teacher. Research clearly documents that beginning teachers are seeking "recipes" that will tell them exactly which action to pursue and in what manner they ought to do that to be seen as the "effective" teacher. Additionally preservice teachers tend to believe that there is not much to teaching (Britzman 1991). Preservice teachers have been watching teachers for years and they believe they know what their teachers will do before they do it. Preservice teachers may think they have seen all there is to see and know most of what there is to know about teaching. Further, according to Britzman, most preservice teachers feel disrespect toward university instruction that attempts to teach them about teaching. They feel that "practice" alone is what they need.

The irony is that preservice students' frustration with university coursework in teacher education is gaining strength just at a time when the evidence clearly indicates that the difficulty of being a good teacher is increasing (Bullough & Gitlin 1995). Preservice teacher beliefs about the complexity of teaching need to be exposed. When field experiences are linked to academic theory and reflection,

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students begin to question their previously held beliefs about teaching and rethink their practice (Wentworth & Hansen 1999). Reflection and the linking of field experiences to theory require a lengthy time commitment of both faculty and students. Field visits are difficult to arrange and do not accomplish the important goals of reflection or linking of theory and practice. Even when students are seen in the field by their university instructor, conversations are often short and deal with a specific event of that day. These constraints are not conducive to serious reflection on the practice of teaching.

Research evidence in educational change theory (Fullan 1993, 1999) suggests that doing things the way they have "always" been done by the majority of teachers will not help solve the problems of education. A model of teacher education that has students learning to teach primarily from already practicing teachers, or learning practice from practice, is a model of simply reproducing education as it currently exists. Teachers need to learn from their experiences and transform both their own practice and serve as leaders in helping their colleagues transform their practice as well. Thus, as teacher educators we are in a quandary. How do we mentor preservice teachers to be reflective about their practice while they struggle to succeed initially in the classroom? Email correspondence may facilitate reflection on practice.

Email correspondence has been cited as an important contributor to educational practice, allowing participants to share reflection with others. Several research studies focus on electronic networks in university settings and report that motivation and comfort level with computer networking are factors that influence students' use of email networking (Feenverg & Gellman 1990, Kimsky 1991). Grandgenett & Harris (1994) reported that number of years of teaching influenced university faculty members' use of computer networking. Gender, age, and previous computer experience are factors in the preservice teachers' use of electronic communication (Downes 1993). Norton & Sprague (1997) report that on-line mentoring for lesson planning was equal to that of face-to-face mentoring with a peer. This study endeavors to analyze the value of email correspondence as a mentoring tool for university advisors of preservice teachers during an early preservice field experience. The assignments given by the university instructor were designed to facilitate the students' reflections on observations in the classroom. The instructor hoped that her responses would mentor the students to be reflective about their observations.

Methodology

The university instructor began an 8-week "exploration of teaching" course with discussions of student beliefs about teaching and what the preservice teachers might observe as they spent several weeks working in the schools. The students were then assigned to a school where they would act as a teacher's aid for four weeks. They were required to email the university professor once each week. Four topics, lesson planning, evaluation, NCTM questioning, and difficult students, were suggested for email topics. The topics were defined and discussed during the opening weeks of the course. The students were also required to collect data for a mini research project while in the schools. The email messages could discuss any problems with the collection of this data.

The university professor set a goal to reply to each email message within a 24-hour period. She attempted to encourage the students when they seemed frustrated, respond to questions in the emails, and ask questions that would spark further reflection from the students. She also reminded them of their data collection responsibilities and of future campus meetings. Following the field experiences the preservice teachers returned to the university for several seminars. The first day was one of unpacking the field experiences. The university professor used the emails as a beginning point to discuss several of the topics initiated in the first two weeks of class. Then the students were assigned to groups to present the data collected in the field. These groups were used for further data collection on the value of the email mentoring.

Each group participated in a focus group interview (Glesne & Peshkin 1992, Connaway 1996) within the week that they returned from the schools. Each focus group consisted of 4 to 7 students. Interviews lasted from 30 to 40 minutes and were audiotaped. Seated around a conference room table, students responded to questions posed by a moderator. Questions for the interview were formulated by the authors in an attempt to gather data concerning the following: 1) the quality of communication and connectedness between student and professor via email during field time, and 2) to what extent the weekly email helped the students to connect with what they learned in the university classroom with what they learned in the field. During the interviews, the moderator augmented the questions to produce more in depth student response.

Results

The 24 students in the class sent a total of 81 email messages. Two students sent five emails messages; nine students sent four; nine students sent three; and four students sent two messages. Forty percent of the email messages were answered by the instructor within 24 hours of when they were sent; 11% within two days; 20% within three days; 1% within four days; and 15% within five days. (The majority of the responses sent five days after they were received were sent to first email messages that were received very early in the first week of the field experience. The instructor had not expected email to come that early so she did not begin responding until the end of the week.) Fourteen percent of the emails were not answered at all. All of the emails were coded for the topics suggested by the instructor during the first weeks of the course, lesson planning, evaluation, NCTM questioning, and difficult students. Almost every student sent an email discussing classroom questioning (25% of all emails) but not all of these focused specifically on the NCTM questioning. Evaluation was also covered by most students (24% of all emails focused on evaluation). Twenty-one percent of emails were listed by the students as dealing with lesson planning. Only 15% of the email messages were focused on difficult students. The other 15% of emails were on other topics. Each of these topics will be discussed to see if the emails help the students connect discussions in class with field experience. Selected email comments and replies will be included.

Questions

Connection to the importance of NCTM questions provided the most thoughtful responses in the emails of the students. During the focus group interviews many students commented that they remembered discussing questioning during university seminars and then seeing questioning in the classroom. The university professor discussed the point of the ineffective and often-posed question to students, "Do you have any questions?" Due to the class discussion prior to the field experience, the majority of the students noticed a "red light" when the cooperative teacher posed this question followed by the lack of classroom response.

In the emails, students commented about the importance of posing questions to students that helped them focus on understand the instruction. They also saw questions as a tool for helping students in the classroom remain focused:

"She will occasionally ask the 'Does anyone have any questions?' question, but it is after she has covered all the preliminary questions. If she doesn't have any response, she will call one of the students names, usually one of them with a perplexed look. She asks the students to explain a certain concept. This seems like a great approach, because she can see if they are understanding." (C. E. 17 September 1999, 16:29:18)

"I noticed that one specific teacher always asks the question 'Any questions?' Not once in the three days that I went to that class has any student ever answered that question." (T. P. 20 September 1999, 13:45:37)

"The hardest thing that I found while taking questions from the students was figuring out how much to tell them in my answer and how much I needed to leave for them to figure out. I found it was good to use an example similar to the problem they are struggling with but that wasn't the exact one in the assignment one." (N. F. 20 September 1999, 15:01:25)

Evaluation

In their emails to the professor, students seemed to define "evaluation" as quizzes, tests, grading homework, and assigning grades. Typical emails about evaluation detailed breakdown of points per quiz/test and percentage assigned to in-class participation. The following email from a student about his cooperating teacher's breakdown for a final grade is a typical example of what student email about evaluation stated: "The final grade in her class is due to 20% homework, 20% quizes [sic], 10% partisapation [sic], and 50% tests." (J. R., Report on Evaluation, 1 October 1999, 19:18:36)

Emails on evaluation tended to be qualitatively superficial, focusing on procedure rather than their own point of view or their cooperating teacher's philosophy. Occasionally, students would reflect that they were thinking about more than just grading procedures, such as this students' comments about her cooperating teacher's use of a test written by text book publishers:

"Also, the test was one of those tests that comes from the book and the questions were pretty confusing. A lot of kids didn't read the directions very carefully and so they lost a lot of points. I don't think that the test accurately represented how well they could do that math, it just showed who could read the directions the best. I think that when I teach I will try to avoid using standard book tests as much as possible." (J. G. Re: Evaluation, 24 September 1999, 2:42 PM)

One student did have a notable exception. She discussed the use of alternative assessment even though she did not use that term: "I also like how instead of tests, for some sections, she gives them projects that test their skills." (J. H., Week #3, 1 October 1999, 14:48:30)

Difficult Student

Emails about a difficult students varied from describing groups of students that were challenging to teach to details about one student with whom preservice teachers tried to establish good rapport. Some emails described the willing student having difficulties with the complexities of mathematics; others talked about rebellious youth that were resistant to learning. These emails tended to be more qualitatively thoughtful. Emails about "the difficult student" often contained realizations about teaching, "all the students aren't easy to teach, even in the advanced classes. Some really require extra time and attention." (L. T., Re: Difficult Student, 4 October 1999, 4:29:12)

Communication about "the difficult student" also tended to be more story oriented, student oriented, and contained emotion as they reflected on *who* they were teaching. Often they also expressed aspirations like this email:

"It's really a challenge to love these kids despite their actions. I've gained a ton more appreciation for my junior high/high school teachers. Teaching is really a thankless job. Kids go on and graduate and leave, sometimes saying nothing to you about your influence. . . I really hope to be a good teacher. One who inspires, looks for the best, is respected and loves her students no matter how they do in math." (B. M. Re: Weekly Report, no date).

Lesson Planning

Many of the email messages about lesson planning were more about classroom instruction than actual planning. An idealized view of lesson planning widely held by college professors is that of the classroom teacher intently at work at her or his desk during planning period, surrounded by resources from which to glean ideas for instruction. Add to this picture several teacher colleagues with whom to discuss both the content and the pedagogy for previous and upcoming lessons, and one has the reality of planning for mathematics instruction in China as reported by Ma in her recently heralded book, *Knowing and Teaching Elementary Mathematics* (1999).

Neither version of lesson planning appears to be the reality for the secondary teachers to whom the students were assigned during the course under study. No students reported collaborative planning among mathematics teachers. Further, no student reported on the actual planning process. Rather, students appeared to infer from classroom instruction the nature of the teacher's planning for that instruction. For example one student reported the following:

"I feel that my teacher, . . . , does a very good job of lesson planning. Each class starts with a warm-up. Which [sic] is a review of the day before. They go over the warm-up and then go into the next days [sic] lesson. She gives the class the objective before she starts the lesson. She introduces new ideas and has the kids help her in developing the idea. Then she has the students either go to the board and work problems, or just work out of the book as a class." (A. D. 24 September 1999, 3:49:29)

Other students mentioned similar lesson routines, and most reported that the teachers they observed relied heavily on the mathematics textbook:

"I got to talk with the teacher about how she does her lesson planning . . . . She does her lesson planning just from the book mostly. She doesnt [sic] write anything down, but just from observing her I can tell that her objective is internally set to help the students understand and have a concrete view of the math." (A. L. 24 September 1999, 4:17:43)

In at least one instance, the student inferred from a discussion with the classroom teacher that that teacher viewed lesson planning as unnecessary:

"When I asked my teacher about lesson planning he did not have a very specific answer. He more or less just comes to class and decides that day what to have the kids do. He does have a set routine the students follow and sticks to it well. Most days the students are just given a lecture and then given an assignment from the book." (J. C. 23 September 1999, 8:36:26)

In summary, little information was included in students' email reports regarding the actual process of lesson planning. Students appeared to infer the planning process from the lessons they saw implemented, and most lessons reported were described as routine and highly textbook dependent.

Conclusions

The email correspondence seem to keep the students connected to the instructor during the weeks they were in the field and facilitate the connection of field experience and university coursework. Many of the students were surprised that the instructor responded to the first email. They were pleased to have feedback from their university instructor. Their emails seem to be more thoughtful the next week, perhaps because they knew the instructor would respond to them. Almost every student reported on three or more of the suggested topics. Very few asked questions or discussed problems with the data collection responsibilities. The university instructor commented that very few of her questions to the students were answered directly the next week. Instead the student reported on a different topic.

Email correspondence seemed to facilitate the connection of field experience and university coursework. Students seemed to reflect about the practice they observed in the classroom. However some reflection seemed to be more focused than others. Some topics seemed to be more clearly defined in the early weeks of the course so the preservice teachers were able to discuss them more deeply in their email messages. In this course evaluation and difficult students were fairly well understood by the students. Many of the email messages focused on procedural issues of evaluation, lesson planning, questioning and not theoretical issues. The instructor tried to ask questions to the preservice teachers to help them reflect about their observations, but few of these questions were answered the next week. The preservice teacher just went on to the next topic. Lesson planning and questioning were less clearly understood so the email messages were less reflective. The instructor needs to be aware that careful discussions about topics for email messages will aid in the depth of reflection of the students as they work in the field.

Further research on the use of email correspondence will be useful in learning how to have preservice teacher reflect on theory and practice as they begin their work as a teacher. While this study focused on the connection of students to instructors, others could look at reflection when students communicate with each other. Additional work could consider allowing students to select their own topics to discuss. Email correspondence does show promise as a way for university work to connect with field experience.

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New Meets New Year Two: Integrating Technology into Inquiry-Based Teacher Education

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ABSTRACT: What happens when an inquiry-based teacher education program encounters a province-mandated Information and Communications Technology (ICT) curriculum? This paper reports on the second year of technology integration efforts in an inquiry-based teacher preparation program. The first three sections provide the context for this endeavor and review strategies employed in the first year of targeting technology professional development in the new Master of Teaching program at the University of Calgary. The final section describes current integration strategies, professional development, and integration projects that are underway for year two of new meets new. *Keywords*: pre-service teacher education, technology integration, problem-based learning, needs assessment, program development.

TEACHER EDUCATION TRANSFORMED

Teacher education programs in this century have generally been organized around an applied science model within which discrete courses are framed by philosophical and theoretical content, and these in turn are followed by short-term "practice teaching" in schools. Beginning in 1996, the University of Calgary embarked on a course of action to discontinue its teacher education programs formed in the conventional mould, and to replace them with a program in which the elements of the professional degree program are integrated, the learners are treated as professionals-in-the-making, the richness of pedagogical knowledge is acknowledged, and cooperative problem-solving is valued. In this new Master of Teaching (MT) program, "courses" in the traditional sense have disappeared to be replaced with professional, case, and field seminars, independent studies, and extensive field experience. The scope of "field" has been extended beyond schools to include a requirements that every student spend a block of time in some alternate educational setting, e.g., zoo, art gallery, museum, prison, special needs facility, social agency, human resources department. Students spend approximately equal amounts of time on campus and in the field from the first day in the program, and the one experience is expected to inform the other.

The campus elements of the program include case, professional, and field seminars. Much of the "academic" content of the program is carried by a series of cases with which students must wrestle, research, take positions toward, and defend their stands. There is a logical progression of series of cases encompassing learners and learning, teachers and teaching, curriculum contexts and issues, living cases from the field during their most intensive field experience, and ethical cases (broadly defined). Each case encompasses far more knowledge than any one student can deal with in the time given—hence the incentive for cooperative endeavors. Team work and collaborative inquiry and problem solving is encouraged, valued, and rewarded. Field seminars provide a forum for the exchange of ideas and experiences gleaned from the variety of educational settings in which a group of students find themselves, not to mention dealing with many of the pragmatic issues which characterize the lives of teachers and students. Professional seminars offer students an opportunity to critically reflect on themselves as teachers-in-the-making, to pursue topics and skills of particular interest, and to engage in the many debates that surround the nature of education and teaching. Now in its fourth year, the MT program has clearly demonstrated its capability to prepare teachers who are energetic, reflective, cooperative practitioners capable of solving problems, confronting new challenges, and taking and defending

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positions on complex issues. The move away from courses taught by specialists has not been without its challenges, however, and one of the first to rear its head was how to re-examine the integration of technology.

THE MT PROGRAM MEETS NEW PROVINCIAL TECHNOLOGY CURRICULA

Concurrent with the changes in teacher education at the University of Calgary is the introduction of a new curriculum by Alberta Learning (the provincial department of education), *Information and Communication Technology, Kindergarten to Grade 12: Interim Program of Studies* (Alberta Education, 1998). Best described as a requirement to teach technology across the curriculum, this approach emphasizes the seamless relationship between technology and the subject disciplines, the process nature of technology itself, and the co-existence of knowledge, skills, and attitudes (KSAs) for technology alongside those for subject areas. The emergence of this new technology curriculum follows in the wake of technology competencies that have been published for beginning and experienced teachers.

Our efforts to design professional development for technology integration are further motivated by a specific requirement that teachers develop competency using communications technology in order to qualify for teacher interim certification. Provincial legislation, in form of the Alberta School Act and specifically the Ministerial Order #016/97 Policy 4.2.1., defines the following technology requirement for teacher interim certification:

> Teachers who hold an Interim Professional Certificate are expected to demonstrate consistently that they understand: j) the functions of traditional and electronic teaching/learning technologies. They know how to use and how to engage students in using these technologies to present and deliver content, communicate effectively with others, find and secure information, research, word process, manage information, and keep records (Alberta Education, 1998b).

From the point of view of teacher education in Alberta, it is not only *desirable* that our students become familiar with the content of the new technology curriculum, *it is the law*.

A considerable amount of research and careful thought went into transforming teacher education at the University of Calgary. What now needs to be considered carefully as this new program evolves is how to address the needs of students to gain the technology competencies and thinking skills required for interim certification. The Master of Teaching program accepts 400 students per year, which translates into approximately 800 students in progress each year. The MT program must address technology in education BUT it must do so within the structure of the new program—the reintroduction of courses is not an option.

TECHNOLOGY INTEGRATION STRATEGIES: YEAR ONE

The authors were charged with the task of developing a framework that dovetails technology with the MT program. We determined it necessary to conduct a needs assessment to identify present technology skill levels and areas of highest need. To this end, we distilled the required learning outcomes of the Alberta curriculum into a competency set that served as the basis for an online survey of students in program. Survey information was used to identify areas upon which we should concentrate our professional development efforts. A complete set of survey results has been published on the World Wide Web (Clark & Jacobsen, 1998). Comparison of 1998 survey findings with Ott's (1996) findings from education students in 1995 permitted us to draw some conclusions about the differences in clientele and entry level skills. For example, more MT students have a computer at home than did students in 1995 (i.e., 84% versus 67%), all of our students hold at least one prior degree (i.e., compared to 20% in 1995), and students entering our program have a higher degree of prior experience with word processing, email and spreadsheets. In brief, our needs assessment told us that with regards to previous computer experience, our students reported the most expertise with word processing, e-mail and WWW browsing and searching. However, a percentage of students also reported having "none" or "a little" word processing experience (9.5%), electronic mail experience (25.5%), and WWW browsing and searching experience (33.3%). Skill areas we targeted for immediate professional development support were those with which a majority of students reported having "none" to "a little" expertise. The high need areas included: accessing library resources using the WWW, spreadsheets, database creation, presentation software, and WWW page creation and editing.

Technology professional development was provided for students in three areas of the MT Program: weekly lecture, a technology skill and integration workshop series, and in professional seminar. As part of their campus experience, MT students attend a weekly lecture series on topics identified with each thematic unit. In order to focus on the integration, communication, decision making, and problem solving aspects of educational technology, the authors prepared and presented two of the winter session lectures for first year MT students on integrating technology. We organized a series of technology workshops to provide skill and integration training in four "high need" application areas: (1) presentation software, (2) web page design, (3) spreadsheets, charts & graphs, and (4) databases for social science. Upon completion of the workshop and a project, such as a web page with internal and external links and graphics, students are presented with a certificate for their teacher portfolio.

INTEGRATING TECHNOLOGY INTO PROFESSIONAL SEMINAR

The first author experimented with integrating authentic technology requirements into the full year Professional Seminar (prosem) she taught with 21 students. The basic intent of prosem is to promote self-conscious learners and teachers. More specifically, prosem opens a space in which students become aware of the differing, sometimes competing sets of values and beliefs that support and frame different kinds of educational practice. Students are encouraged to see teaching and learning from multiple viewpoints-- to understand the complexity and contradiction inherent in these perspectives, to be able to choose and generate multiple possibilities for action, and to see what one's choices both allow (legitimate), or disallow (suppress). The instructor structured prosem using the following five components: (1) Weekly readings with required written interpretive and critical responses, (2) Group discussion/debate, and individual and group presentations, (3) Generative discussion periods for articulating and examining lived experience, (4) Biography of Learning / Independent Inquiry / Scholarly Writing workshop sessions, and (5) Individual consultation / feedback sessions. Student assessment was narrative, and was based upon participation and contribution to weekly seminar, responses to required readings, creative writing and narratives, two independent inquiries, and three biographies of learning.

Given the goal of creating a collaborative on-line community of scholars, students took on the task of learning how to publish and exchange the results of their written coursework and investigations using individual World Wide Web homepages. Students met with the instructor for additional hands-on instruction both before and after scheduled seminar time, and on alternate days, in order to develop their skills in HTML and web publishing. Eventually, all students learned how to find resources on the web, create new HTML documents, convert existing word processed documents into web pages, incorporate graphics and links, and upload their web pages to a public web server. Some students learned how to convert and upload PowerPoint presentations to their web sites, to construct animations, and incorporate sound and video into their web documents.

This experiment with integrated technology requirements in professional seminar worked. We created images of how students in the MT Program can work with technology and web-based environments to create scholarly electronic communities. The integration of technology into prosem also assisted us in better defining the challenges ahead as we work to integrate technology across the Master of Teaching program. The additional time required to prepare for and to integrate technology in this one course, and the ability and skill levels required of the instructor, lead us to conclude that issues of faculty workload and professional development requirements will be primary considerations in drafting plans for faculty-wide integration. Several additional hours per week over an entire semester, for both faculty and students, is a significant commitment to ask of people. Therefore, we will have to focus carefully on the learner outcomes the faculty plans to target and realize that any and all integration efforts will require that individuals invest time in their own professional development and instructional planning in order to yield the expected returns. Even with years of educational technology experience and bushels of enthusiasm and commitment, the lived curriculum with regard to technology integration can be anything but neat and tidy! Computers freeze, network connections are busy or go down, the projector bulb burns out, floppy disks and hard drives die, and students ask questions that cannot be answered on the spot. However, in the midst of all of this apparent chaos, students create amazing and extensive projects, develop remarkable technology skills, discover the fallibility of technology, overcome some of their technology-related fears, and invent neat ideas for technology integration in their future classrooms. The challenge will be to convince our colleagues to persevere in spite of these expected, and often inevitable, technology glitches and failures, and provide the necessary support and just-in-time training as they work toward meaningful integration of technology into learning goals and processes.

NEW MEETS NEW IN YEAR TWO

A number of recommendations, in the form of goal statements, were made to the Faculty of Education Curriculum Planning Committee as a result of our first year technology integration efforts and literature on technology integration, professional development, and ICT leadership (Jacobsen, 1998; Stein, Smith & Silver, 1999; Yee, 1999): (1) take steps toward the ubiquitous integration of technology into the MT program, (2) plan for and support faculty members' professional development for technology integration, (3) create an electronic communication medium for all MT students and faculty, (4) disseminate instructional materials about technology access and requirements, and (5) offer an extended MT technology workshop series in 1999/2000.

TECHNOLOGY INTEGRATION COMMITTEE

The first recommendation was to reconceptualize the end goal of "ubiquitous integration of technology for learning" from being a sole responsibility of the "educational technology folks", and repositioning it as a faculty-wide vision and commitment. The new provincial curriculum requires *all* teachers to integrate technology across the K-12 curriculum. Technology as process is every teacher's responsibility. Therefore, technology integration efforts on campus should be undertaken by faculty across all curricular specializations, rather than relegating it to the technology specialists. To this end, one of us has formed and now chairs a Faculty of Education Information and Communications Technology (ICT) Integration Committee. When selecting potential committee members, careful consideration was given to appropriate representation and diverse membership. A goal was to promote a faculty culture that explored fundamental teaching and learning issues, rather than emphasizing the adoption of technology for technology sake, so it was important to solicit and include views from both adopters and non-adopters in the faculty, in schools, business, and government about the relative advantages of technology for teaching and learning. Therefore, the committee includes Faculty of Education colleagues with expertise in areas other than educational technology, colleagues with expertise in educational technology, the Director of the Doucette Resource Centre, individuals from Calgary-area school boards, a member from the Galileo Educational Network, an individual representing Alberta Learning and the leading author of the new Information and Communication Technology Interim Program of Studies for Alberta, and an individual from industry with technology expertise.

The committee's goal is to create a shared vision by working to establish a Faculty Wide Technology Integration Plan. This document will provide a flexible and responsive plan that will guide rather than constrain integration efforts that are in alignment with the University Technology Integration Plan and the teacher certification requirements of Alberta Learning. An outcome of this Technology Integration Plan will be to address the second goal, that of determining the technology professional development requirements of faculty members, and developing appropriate strategies access to technology, training, and support. In order to realize the potential benefits from technology, the faculty as a whole needs to find ways to encourage and assist faculty members with the adoption of technology for a variety of teaching, administrative, and research tasks. Without attention to the human infrastructure, nothing of value will be achieved with the technological infrastructure (Jacobsen, 1998).

SPECIAL TOPICS SEMINAR FOR SECOND YEAR STUDENTS

An opportunity for advanced technology infusion in the MT Program has presented itself in the form of the second year special topics seminar. In their final semester, second year students enroll in a special topics seminar which allows them to extend and deepen their understanding about a particular aspect of education. A list of diverse topics for special seminar is made available to students in semester three, and students indicate their preferred topics. A special topics seminar entitled "Integrating Technology Across the Curriculum" has attracted 45 second year students for the Winter 2000 semester. The normal class size for special topics seminar is 15 students. Instead of offering 3 separate seminars, the first author and two colleagues with expertise in educational technology have been afforded the innovative opportunity to team teach a combined seminar with all 45 students. Goals of this seminar include: (1) investigating fundamental teaching and learning issues that surround the use of information and communications technology in educational settings, (2) examining both the potential and the limitations of educational technology use, (3) providing a forum for discussion of conceptual issues related to educational technology and the Alberta Learning Technology Outcomes, (4) participating in a collaborative, electronic community to publish, exchange and consider emerging ideas, (5) engaging in practical exercises that have classroom application for student learning, and (6) acquiring some proficiency in the use of various computer applications. A component of the seminar will be to critically analyze, build and extend upon innovative professional development strategies described by Stein, Smith & Silver (1999) with regard to technology integration, and approaches to ICT leadership outlined by Yee (1999). Students will be responsible for producing a portfolio demonstrating advanced technology understandings and skills. Portfolios will be assessed by the seminar leaders, along with student-selected peers, public school and university faculty members.

EGALLERY: ELECTRONIC PUBLICATION OF EXEMPLARY STUDENT WORK - http://www.ucalgary.ca/~egallery

The third goal, to create an electronic communication medium for faculty and students, has opened a space for an innovative publication medium for student work. A number of faculty members, teachers, and two second year MT students have formed an editorial team and have created the EGallery, a web-based peer-reviewed publication of exemplary student scholarship. EGallery's mission is to provide an electronic medium for international publication and consideration of exemplary scholarly work produced by Master of Teaching students in the Faculty of Education. The editorial team seeks submissions of critical essays, independent inquiries, and biographies of learning from first and second year Master of Teaching students. All submissions are subject to a peer review process.

To get to the stage of a full-scale launch of the EGallery, a number of different development tasks needed to be undertaken by the editorial team. We needed to: (1) discuss and develop a mission statement, (2) define our intended audience, (3) outline our purpose, (4) establish publication and submission guidelines, (5) establish a review process and criteria, (6) consider how we might involve others, (7) consider who might become reviewers, (8) design advertising and promotion strategies, (9) canvas for academic and financial support, (10) establish an e-mail account and web page directory on the University of Calgary server, and (11) design and develop the website.

Development work has also included, not exclusively: (1) designing HTML documents and graphics for the core website, (2) designing and publishing paper-based promotional materials, (3) formatting and publishing the first two submissions for review, (4) creating a review form that will e-mail results to the editors, (5) inviting others to become part of the editorial team, (6) inviting peers and students to become reviewers, (7) fielding numerous questions from peers and students, (8) recording and discussing suggestions and advice from others, and (9) editing, refining, and maintaining the web site.

There are some technological and infrastructure requirements to consider when launching an online publication of this type. The EGallery website is hosted on a University of Calgary public web server, and linked to the official Faculty of Education website. The editorial team considered it crucial to have both the Dean and the Associate Dean's public support of the EGallery, and sought their advice and advocacy. The Department of Teacher Preparation in the Faculty of Education has generously supported EGallery by providing photocopying for promotional materials.

We have published a prototype issue of the EGallery with two exemplary independent inquiries about teaching mathematics. Our immediate goal is to publish the first issue of EGallery in January 2000 with six exemplary pieces of student scholarship. Our future plans are to fully explore how EGallery can become an active and inviting space for critical discussion among experienced educators, faculty members, and student teachers about educational issues and topics. We plan to investigate how the editorial team might facilitate ongoing and sustained conversations that build and extend upon issues raised in the published work.

TECHNOLOGY HANDBOOK

The fourth recommendation was based upon an observed need for instruction, access, and support materials that students could access for individual training and support needs. Plans are underway for the creation of a technology handbook for faculty members and students. This document will be available on the Faculty of Education web site as both HTML and PDF documents, and will provide useful information about technology integration activities, professional development, and resources. A preliminary list of topics and resources that will be addressed in the Technology Handbook are: 1) requirements and expectations for technology integration by Alberta teachers for Interim Certification by Alberta Learning, 2) where to access and how to print Alberta Education online resources (PDF files) and curricular documents, 3) how to get e-mail account and how/why to use it (i.e., communication with faculty, peers, cooperating teachers), 4) how and why to sign-up for list server, and 5) the URL for Faculty of Education web site and description of relevant online resources.

MT TECHNOLOGY WORKSHOP SERIES

We have organized an extended MT Technology Workshop Series for the 1999/2000 instructional year that includes instruction in getting started with technology, personal writing, communication and research skills, creating computer-based slide presentations, and graphics creation and integration. A fundamental goal for all of the workshops is to provide images of how the new ICT curriculum might be lived out in the classroom with students.

The first workshop was designed for beginners who wanted to develop a better understanding of computer terminology and components, to navigate basic operating system features, to word process, save to disk, and print a basic document, to access technology resources in the faculty, and to set up an email account with the university. The second workshop was developed for beginners who wanted to refine their writing, communication and research skills using a computer. The workshop was designed to help students to develop general word processing skills (i.e., new, open, save, print, page numbers, double spacing, formatting, insert clip art, and so on) for their major writing assignments, to use email to communicate with others (i.e., instructors, partner teachers, and peers) and to exchange attached files, to use various search engines to locate research information on the World Wide Web using a browser, to download and open Curricular documents, such as the Technology Outcomes document, from the Alberta Learning Website (Alberta Education, 1998). The third workshop was designed to provide instruction on developing computer-based slide presentations. Students learned how to create PowerPoint presentations using the Wizard feature, design a new presentation from blank slides, develop a new presentation using the color templates, add graphics and special effects, and most importantly, explore how presentation software can be used for writing and research in the classroom with/by students. The fourth workshop built upon skills learned in the first three workshops. Students learned how to integrate graphics into word processing and presentation documents, to create graphics using a flatbed scanner to digitize photographs, drawings, and other media, to use a spreadsheet to create simple charts and graphs, and to create drawings and figures using draw tools. Students also learned how to download images from the World Wide Web for use in word, presentation, and web documents.

Three additional workshops will be offered in the Winter 2000 instructional session: database design and integration, manipulating numerical data using spreadsheets, and web design and HTML.

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Teachers Learning about Software Implementation

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Abstract Knowing how to integrate computer resources into curriculum is far more important than finding what resources are available, where the former requires the knowledge and skills of evaluating, planning, designing, and enforcing. Most teachers today, however, lack knowledge of and experiences with software implementation. This paper describes an experience of 23 teacher education sophomore students observing school children exploring the Magic School Bus CD-ROMs and discusses several related issues, including students' perception, children's performance, the usefulness of the software programs, and other issues.

Introduction

Throughout many years of working with teachers, I have heard many teachers ask, "What computer resources or software are available for my teaching?" Surprisingly, very few teachers have asked, "How can I best use the existing computer resources for my teaching?" Although most teachers are eager to know what resources are good for their class to use, it would be improper to assume that teachers already know how to integrate existing resources in their curriculum and they only need to know what resources are available and how to acquire them. By talking with school teachers on various occasions, I found that many teachers have faith in computers and believe computers can enhance content teaching and learning although these teachers did not have experiences using computers in teaching, nor did they know exactly how students would react toward the computer resources being used in any given situation.

Knowing how to integrate computer resources into curriculum is far more important than finding what resources are available, where the former requires the knowledge and skills of evaluating, planning, designing, and enforcing. As Dias (1999) indicated, although electronic resources are widely available, how software may be best integrated into curriculum still remains a puzzle among most teachers. Oftentimes, teachers are unaware of the students' needs when assigning computer-related learning tasks for students to complete.

To help preservice teachers better understand the actual use of computer programs for teaching and to help some local elementary school children gain a better understanding about what it is like when learning in a college computer lab, a special arrangement was made to invite local elementary students to the College of New Jersey campus. Forty-five children in grades 1 through 5 from a professional development school in Trenton, NJ, came to the college. The sophomores in the Analysis of Teaching class met with these elementary school students in a campus computer cluster. The children were given an opportunity to explore the Microsoft Magic School Bus CD-ROMs, and the college preservice teachers observed and helped them with this experience. The preservice teachers gained more sophisticated understandings of how

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children approach software as they observed and documented this experience. After elementary students had a good time learning while playing on computers, they were asked to share how they felt about the software and what they enjoyed most about such an experience.

Based on the results of the children's visit and exploration on the software, this paper explores various issues with reference to the following questions:

1. How did elementary students react toward the Magic School Bus software?
2. Are there changes in preservice teachers' perceptions about how elementary students would perform or benefit from using the software program before and after this experience?
3. Do elementary students prefer the use of the Magic School Bus software for learning to the traditional classroom instructional approach?
4. Do elementary students' attitudes change after they explore the software?
5. Do college students perceive the use of such a program superior to the traditional approach of instruction?
6. Are there any differences in performance between the younger students and the older students?
7. How well do the preservice and inservice teachers know about software implementation?
8. Under what circumstance will elementary students benefit from the software?
9. What did the preservice teachers learn from this experience?

Magic School Bus Series

The Magic School Bus (MSB) CD-ROM programs, designed and developed jointly by Scholastic and Microsoft, are based on a series of books and video tapes that center on science explorations in various topics, including exploring the ocean, inside the earth, the human body, the rainforest, and the Solar System.. This highly interactive program series features Ms. Frizzle, a teacher who, with the help of a magic school bus that can go anywhere and do anything, provides her students with outrageous field-based science experiences. The CD-ROMs attempt to simulate journeys presented in the books and tapes and to engage children actively in science through various activities. The design of the series is based on Ms. Frizzle's teaching approach: exploring, getting messy, and finding solutions to problems encountered by students. The CD-ROM programs are intended for teaching and learning with the constructivist's approach.

The visit of school children

Forty-five children in grades 1 through 5 from Christopher Columbus School, a member school from the Professional Development School Network, in Trenton, came to The College of New Jersey. Twenty-three college sophomores in the Analysis of Teaching class met with these elementary school students in a campus computer cluster. The children were given an opportunity to explore MSB CD-ROMs, while the college students observed and documented them as they did so. These children later shared how they felt about this trip and what they have learned from using the Magic School Bus CD-ROMs.

The procedure

Prior to the children's visit, the sophomore students rated the MSB software based on their own observations and perception. During the visit, each sophomore student observed two pairs of school children who explored the software together for two one-half hour periods. The children were randomly assigned to work in pairs on one of the MSB CD-ROM titles for a half hour, then worked on a different MSB CD-ROM title for another half hour. After the observation, the sophomore students rated the MSB software again and wrote reports describing their observations. In addition, before and after the elementary students' visit, sophomore students were surveyed about their perceptions and attitudes concerning the usefulness of using the MSB programs for teaching and learning. The sophomores were encouraged to answer the question, "Did the children succeed in using and learning with the Magic School Bus software?" The Columbus School children were also asked to share what they perceived about their Magic School Bus experience. The data collected are primarily from the sophomore students' pre- and post-survey as well as their reports about their perceptions and findings from observing children using the software.

Results

This paper addresses some key issues related to appropriate software implementation. Derived from careful observations of how college students interacted with the elementary school children on the computer tasks, how sophomore students interpreted their observations, and gathered from the pre- and post-surveys conducted with all participating preservice teachers, some interesting findings are worth noting. Many preservice teachers didn't actually learn how to integrate software into instruction until they had a chance to interact with both the software and students. As a result of this experience, many preservice teachers developed a different perspective about the best way to implement software in teaching. Through an informal discussion with the two teachers of the students in this study, it was determined that they had an incorrect notion about how their students would react toward the software and how the software may be best used to enhance teaching and learning. Like many others, these two teachers assumed that having students learn with software would automatically result in positive learning outcomes. A further report of the findings is presented below.

Sophomore students' attitudes

In general, students held good faith in software and advocated the usefulness of the software. Although a few sophomore students expressed different concerns of the software implementation after they observed these children exploring the software, there were no significant changes in their general attitude toward this particular software or toward the general use of educational software for instruction. This may be partially due to the insufficient amount of time allocated for children to use the software for learning, and partially because there are no lesson plans or other activities to go along with the software; it became impractical to assess the value of the software when it is irrelevant from the intended learning contents.

Sophomore students' beliefs

As evident in their observation reports, most sophomore students believed it was worthwhile to use software in instruction because:

- it has information value
- it can give the teacher instructional ideas
- it expands children's horizons
- it allows children to explore new concepts
- it engages children in learning in an exciting way
- it allows students to have fun while they learn
- it stimulates the senses and allows children to express their creativity
- it provides physical participation that keeps children focused
- it provides a relief from lecture-style teaching
- It is a reprieve from traditional learning methods
- it gives children a choice and allows them to take control of their own learning
- it is valuable because children like it
- it builds confidence
- it inspires children to use computers, and children need computer skills for their futures

Learning with CD-ROMs vs. learning with Ms. Frizzle

It is interesting to compare a regular classroom setting with Ms. Frizzle's class. Many sophomores can easily identify some major differences, including the language used by Ms. Frizzle, the efforts for the class preparations, the concept of student safety, the flexibility of class time and activities, and the passion for new knowledge. Students were also encouraged to compare learning with CD-ROMs with learning with Ms. Frizzle. Most students considered the similarity between the two, while some students pointed out some differences. These comparisons are listed below.

- "Ms. Frizzle rarely answers the children's questions directly; she allows them to learn hands-on. Similarly, the software gave little instruction; the children have to figure out how to use it."
- "The CD-ROM offers an independent learning experience for children, in which they are free to explore and learn on their own. This is similar to Ms. Frizzle's methods in the cartoon classroom. She is not concerned with telling children things; rather, she favors a method where children discover things for themselves, with very little direction from their teacher."
- "The teaching that is embodied in the CD-ROM is *different* from that of Ms. Frizzle. Although it encourages independent learning and allows children to explore different areas, it keeps them in a controlled environment and constantly spits out facts. Ms. Frizzle's mantra is 'take chances, get messy, make mistakes.' When interacting with the CD-ROM, I realized

Sophomores' observations about children using the MSB software

- The CD-ROM offered little direction. Some children could navigate with ease, but others required extensive guidance. Most observers felt this impaired learning.
- Younger children generally liked the software more than did older ones and were excited by the sights and sounds they were able to create.
- Children were engaged with the video game-like activities and had little interest in the facts.

- Only a few children took an interest in the game around which the software was organized.
- There was little knowledge embedded in the games, and few children could identify anything they had learned. While some activities had more learning than others, all had some educational value.
- Children were generally good at sharing the mouse and working together.
- Children tended to click around, avoiding difficult activities or those that involved a lot of information.
- A half hour was not enough time for children to become engaged with the software.

How would sophomore students use the software for their future teaching?

Elementary students were frequently carried away by the bells and whistles presented in the software and ignored the intended learning content. Simply putting students to work on a computer program does not necessarily guarantee learning success. Sophomore students suggest implementing the software for teaching:

- as the primary source of instruction for older children.
- as an introduction to a unit.
- as a supplement to a unit once children knew the basics.

Children's reaction toward the visit

The children shared their perceptions with us and almost all of them gave positive feedback regarding their experience. Most children were excited to have an opportunity to visit the college computer lab and work with college students. They were strongly motivated to explore the CD-ROM programs and thought this experience was fun. Although most children had encountered some difficulties in figuring out what to do in the program at various stages, they did not seem frustrated. In fact, many children seemed to pay more attention to running the MSG programs rather than focusing on the learning contents.

Implications

- Software integration is complex. Know it well, pilot it on children, and use it appropriately.
- Time pressures may make it difficult to use software effectively.
- Preservice teachers believe that learning should be fun.
- Preservice teachers equate constructivism with hands-on learning and don't see a difference between Miss Frizzle and the CD-ROM.
- Preservice teachers like the idea of software but are afraid of its random quality.
- Preservice teachers are technophilic.

What did the sophomores learn?

- They found that children are fast in catching up with new computer applications. It took adults longer to figure out something in the program than children.
- It is important to find appropriate software to supplement teaching. Not all the materials are good for instructional needs.

- Putting students in the computer lab to explore the Web or software applications will not automatically help students learn better. Lesson planning is essential to ensure the success of the software implementation. To maximize the learning, teachers should relate the learning contents with the computer programs as well as with students' prior experience.
- When applying software in the school, there may not be sufficient hardware or software resources. The cooperative or collaborative learning setting is beneficial to engage students in learning from each other.
- Software implementation requires time. It will take plenty of time for teachers to prepare the lessons. It will also require much time for students to explore the programs. Not until they can manage the program well enough will they be able to engage in active learning through activities.

Summary

Knowing how to integrate computer resources into curriculum is far more important than finding what resources are available, however, most teachers lack knowledge of and experience with software implementation. By inviting some elementary school children to The College of New Jersey to explore the Magic School Bus series, sophomore students developed a better sense of software implementation while observing children using the software. They also developed a better understanding about some other related issues which are essential for software implementation in the classroom.

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Implementing Mandated Information Technology Infusion into Teacher Education: California Cases

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Abstract: California legislation recently mandated that credential candidates meet specified technological competencies before being recommended for a California State Teaching Credential. This paper describes how a large teacher preparation institution and an innovative alternative to certification offered by the California State University system are responding to this legislation. Faculty involved in the implementation efforts discuss issues and challenges faced and share examples of information technology infusion in a variety of teacher education courses.

Technology Infusion in the Credential Program at CSUF–Roy M. Bohlin

As a result of recent legislation in California, the faculty at California State University, Fresno were faced with a dilemma of how to make sure that our credential graduates met specified computer competencies. There are several ways in which technology competencies can be implemented into a teacher credential program, but some of these were not an option for us. Because our current credential program doesn't allow room for additional courses or credit hours, we had to find a way to infuse technology into the overall program. For us the greatest barriers to the infusion of computer experiences include the following:

- Many part-timers teach many sections of our core courses on a rotating basis.
- In spite of a new technology enhanced building with four complete computer labs, many sections are assigned outside of our building and many classrooms do not have a computer and/or an internet connection.
- Many of our faculty were not comfortable with moderately high levels of computer usage.

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To address these problems, the Dean and Department Chairs first identified several key courses to be the focus of the infusion efforts. These courses in which the major infusion responsibility would be placed were:

- Curriculum and Instruction
- Mathematics in the Elementary School
- Psychological Foundations
- Teaching Reading.

I was asked to coordinate the effort to infuse technology into our credential program, while focussing on these courses. The process of getting faculty onboard was begun by holding a meeting in which key faculty were asked to help make decisions about content and timing for a weeklong workshop during the summer of 1999.

Because the reading faculty were already saddled with their own competencies, the reading course was done separately. Their infusion was coordinated by a member of that department, who had previously worked on Web-enhancements in several courses.

A weeklong workshop was scheduled in June and 12 faculty were able to participate. They all had some familiarity with both word-processing and e-mail. During this week faculty were:

- Introduced to the new labs, computers, and network
- Familiarized with several applications (e.g., PowerPoint, Netscape Navigator and Composer, HyperStudio) and search engines (e.g., Metacrawler, HotBot, Sherlock)
- Shown model examples of how technology can be used in student-centered higher-order thinking lessons
- Provided with the opportunity to meet with exemplary technology using teachers, technology coordinators, and other resource people to discuss what students need to know and how we might better prepare future teachers to use technology
- Given time to thoroughly examine and discuss the content of their courses to make decisions about how technology might be best used to achieve their curricular goals.

Stipends were provided to the participating faculty. The feedback from the participants was very positive. They enjoyed the opportunity to learn about infusing technology into teaching and they also enjoyed the opportunity to meet with other faculty and discuss many different issues related to their courses.

Two matrices were developed during the week, one for the Multiple Subject and one for the Single Subject programs. Faculty selected those competencies that fit the needs of their students and the content of their courses. The selected competencies were identified as being either primary or secondary responsibility in each course. Actually, very little negotiation was needed to cover nearly all of the competencies with these selected courses. The few that did remain "unclaimed" were added to either the general curriculum classes or as part of the field experience courses.

Individuals from each of the four courses volunteered to serve as leaders in the fall, to pilot the full infusion plans developed by the teams. The others agreed to try infusing one or two of the new assignments or lessons. I met with the course leaders and talked with their team members late in the semester to discuss progress and to help participants move through a formative evaluation process. The revised plans are being implemented in Spring 2000 semester. Additional stipends were not available for this continued planning and work, so the effectiveness of this part of the process was very limited.

Also during the 1999-2000 academic year, I am planning several follow-up workshops and professional development experiences aimed at helping faculty to gain more knowledge and confidence of computer use. Some of these experiences will be coordinated with a grant that will provide some support and small stipends for faculty. Additionally to help provide technical support while faculty are teaching, a lab support person is scheduled to be available to help with hardware and software problems three evening a week. He has also helped faculty by teaching some of the technical skills to students in some of the classes.

Designing Meaningful Activities for the Elementary Curriculum and Instruction Course–Robin T. Chiero

The newly adopted technology standard mandated by California states that credential candidates must "demonstrate knowledge and use of computer-based technology to enhance and support teaching and learning". There are a number of competencies that indicate that this standard has been met. One of the courses designated to address a number of the competencies was the course titled "Curriculum and Instructional Methods in the Elementary School." In this course students explore a variety of topics, issues, and instructional strategies related to curriculum theories and practices in the elementary school (K-8), and learn how to plan lessons and create instructional units.

One section of the course was selected to serve as a pilot to integrate activities that would enable students to meet the competencies. The students in the course were in a cohort program designed for "re-entry" students (students going in to teaching from another career). Consequently, the students were, for the most part, older than students going directly into a credential program after completing their undergraduate work. There were 24 students in the course, sixteen females and eight males. Results of the pilot will be used to provide information necessary to revise activities and ensure that they can be consistently met across all sections.

There are, in a sense, two perspectives of technology integration in such an effort. First is the use of technology in the curriculum course so that students see the advantages technology can have for their own learning. Second is the issue of providing them the knowledge and skills for using technology in their classrooms. A group of professors who teach the course met to determine what activities would be. Table 1 shows the competency and the corresponding activity.

Competency	*Activity*
Uses computers to communicate through printed media	Combine text and graphics to create a newsletter for parents that introduces the instructional unit
Uses computer applications to manage records	Use a spreadsheet or grading program to manage student records Explore the use of electronic portfolios as a means of assessment
Chooses software for its relevance, effectiveness, alignment with content standards, & value added to student learning	Use the California Instructional Technology Clearinghouse database on the Internet to investigate potential educational software to be used in the classroom
Selects appropriate technological resources to support teaching and learning	Locate web-based resources for instructional unit and evaluate using specified criteria
Is familiar with a variety of computer-based collaborative tools	Use Web-based course materials for course information and communication
Demonstrates knowledge & understanding of the appropriate use of computer-based technology in teaching & learning. Analyzes best practices & research findings on the use of technology & designs lessons accordingly. Considers the content to be taught & selects the best technological resources to support, manage, & enhance learning	Incorporate technology activities into an instructional unit

Table 1. State-mandated Competency and Corresponding Activity

Goals of Designing Course Activities

Three major goals in designing the activities were to (1) provide opportunities for students to demonstrate their competency; (2) design activities that are relevant to course content; and (3) model appropriate use of computer-based technology in the classroom. To meet the first goal, students had opportunities to demonstrate their competency in a number of areas. For example, a major assignment in the course is to create a two-week interdisciplinary instructional unit. Included in the requirements for the unit were to use a spreadsheet as part of the assessment component, to incorporate text and graphics into a letter to parents describing the unit, and to incorporate technology into unit lessons. Although students did not have hands-on practice, electronic portfolios as a means of assessment were discussed. In addition, the course web site supported a Bulletin Board in where students could discuss topics covered in the text and pose additional questions. Also available at the course web site was the syllabus and course materials based on lectures and class activities.

Challenges and Opportunities

One major challenge encountered was one that has historically been a major obstacle to computer integration–that of access. The cohort program is a site-based program and all classes are held in a portable classroom at an elementary school site. This was the first year at this site, and for the first several weeks there were no computers in the classroom. Eventually three computers were made available for the portable, but without Internet access and without a projection device. The logistics of borrowing a projector from the School of Education and taking it out to the site were difficult. Another access challenge was access to software. The computers supplied had limited productivity software installed, but had no educational software for students to examine and evaluate. These circumstances limited the amount of modeling that could be done in the course.

Another, and perhaps more important challenge was to design activities that demonstrated the true power of the computer to support teaching and learning, not merely activities that added to the demands of the course. In this pilot, although activities provided students the opportunity to demonstrate their competence in a number of areas, the activities need to be revised somewhat to show how computers can support the teaching and learning process.

An unanticipated opportunity arose as a result of the coming accreditation visit the School of Education and Human Development will have next spring. Each program is to create a visual display that describes the program. The program coordinator and I decided that this would be a good opportunity to model the use of a multimedia program to convey information. One assignment was adjusted to allow additional time to create the project. As a whole group we decided what major topics we wanted to include. I presented a brief introduction to PowerPoint. Students then were divided into groups with each group taking a topic. Groups designed their slides on index cards before going to the computers. Then they entered the information on slides. Due to time constraints, we didn't have time to complete the final product during class time. An indication of their interest was that many students requested they be able to finish the project, as they had a particular vision of what they wanted to convey. We have set aside a date during the winter session where they will be able to complete the project.

Conclusion

Despite the challenges encountered during the pilot course, students indicated positive attitudes regarding the importance of incorporating computer-based activities used in the course. Early in the semester, one class session was held in a computer lab on the University campus so students could practice accessing the course web site and other Internet sites and so they could explore some of the educational software programs available in the labs. The bulletin board was widely used throughout the semester, not only to respond to questions posed about text material, but also to discuss student teaching experiences, ask questions, and share ideas and resources. With the access to computers problem solved from the start of the semester, other more sophisticated issues could be more satisfactorily addressed. Activities incorporated in to the pilot need to be revisited to ensure that they not only address the competencies, but that they model the strengths of technology in supporting student learning.

Technology Infusion in an Elementary Mathematics Methods Course–Carol Fry Bohlin

At California State University, Fresno, all Multiple Subject Credential Students are required to take CTET 121, a three-unit course in mathematics teaching methodology for the elementary school classroom. Following the one-week Technology Infusion Workshop described above, I completely restructured my assignments to provide multiple opportunities for my students to become comfortable using technology as a resource for their current and continued professional development in mathematics education. Eleven assignments were developed that incorporated the following technology competencies: the student (a) is familiar with a variety of computer-based collaborative tools (e.g., threaded discussion groups, newsgroups, list servers, online chat, and audio/video conferences); (b) demonstrates competence in the use of electronic research tools (e.g., access the Internet to search for and retrieve information); (c) interacts with others using email, and (d) demonstrates knowledge and understanding of the appropriate use of computer-based technology in teaching and learning. A number of other competencies were also addressed to a lesser extent in the assignments or by the guest speakers–elementary teachers who provided an inspiring vision of the range of possibilities for technology's effective use in the K-6 mathematics classroom.

All students were required to have an email account Those who did not already have an account were provided with a free University account prior to the second day of class, at which time the class met in a computer lab for hands-on experience with e-mail, Web browsers, spreadsheets, databases, and word processing programs. A discussion was held about attaching files, hot links, characteristics of various e-mail programs, Netiquette, and various differences between Macintosh and MS-DOS computers. During this first class session, the assignments were discussed in depth, and I demonstrated how to join a listserv. The class met in a computer lab the following week and was given a handout of "Must-See Web Sites for K-12 Mathematics Teachers." They explored sites such as the National Council of Teachers of Mathematics, the California Mathematics Council, the California Department of Education (with links to the California Mathematics Content Standards, to the California Mathematics Framework, to the list of recently-approved mathematics textbooks, and to schools' scores on the Stanford Achievement Test (SAT 9), Eisenhower National Clearinghouse, EducationNews.com, and The Math Forum.

The students were also added to my personal distribution list–"OMEN" (Online Mathematics Education News) to help keep them apprised of the latest developments in mathematics education at the local, state, and national levels. They will remain on this list following the completion of the course.

Assignments

All course assignments were submitted to me via email; one assignment had to also be distributed electronically to all students in the class. Each assignment was required to contain a concluding paragraph where students reflected on the assignment (e.g., its value, what they learned, ease of completion), their feelings about using e-mail and other computer applications, their thoughts about the class, and anything else they wanted to express. Below are very brief descriptions of the assignments:

(1) **Statewide Test Results**–Students looked up the SAT 9 (Math) and Math Augmentation test scores for a selected school at the STAR Web site (http://star.cde.ca.gov). They then interviewed teachers and administrators at the school about steps that were being taken to address student performance on these tests.

(2) **Report on Classroom Technology Use**–Students interviewed a teacher from each of three different grade levels at an elementary school to see how these teachers infuse technology into their mathematics curriculum. Students are given a number of issues to address in their paper.

(3-5) **Online Article Reviews**–Students went to the National Council of Teachers of Mathematics (NCTM) Web site for three months (September, October, and November) and selecedt an online article from one of the four NCTM publications to discuss and critique.

(6) **Listserv Membership** –Students joined a mathematics education-related listserv (e.g., math-teach, TIMSS-Forum, AMTE, or NCSM) and wrote a report summarizing their experience (discussions, etc.). They were encouraged to participate in the discussions, and over half of the students elected to do so.

(7) **ENC Web Site**–Students became familiar with all aspects of the Eisenhower National Clearinghouse (ENC) Web site (http://www.enc.org/). ENC publishes an outstanding magazine, *ENC Focus: A Magazine for Classroom Innovators*. Students signed up for a free subscription at http://www.enc.org/focus/ . They also wrote a critique of an articls in each of several issues of ENC Focus.

(8) **"Ask Dr. Math"**–Students submitted a math-related question to "Dr. Math" at the Math Forum site (http://forum.swarthmore.edu/) and reported "Dr. Math's" response.

(9) **Search Engine Exploration**–Students picked a math-related topic (e.g., Fibonacci numbers, pentominoes, tessellations, division of fractions, Platonic solids, etc.), and used MetaCrawler, Ask Jeeves, HotBot, and AltaVista search engines to investigate sites related to their topic. They wrote a report comparing and contrasting each of these search engines.

(10) **Web-based Lesson Plan**– Students went to the "lessons" portion of the SCORE-Math Web site (http://score.kings.k12.ca.us/). The site contains teacher-developed, Web-based lessons that are linked to the California Mathematics Content Standards and the NCTM Standards. The students developed their own Web-based, standards-based lessons and shared them in class. Students were also invited to submit their lessons to the SCORE-Math site, and received $200 if their lesson was accepted.

(11) **"What I'll Remember Five Years From Now"**–Students mentally projected themselves into the future to reflect upon what they will recall from CTET 121. I have found this assignment to be one of the most valuable for me as an instructor, and the students appreciate the opportunity to reflect on the semester and see what aspects of the class stood out in their mind and what knowledge and meaning they constructed from the class.

Reflections

The reaction to the assignments and the focus on technology has been overwhelmingly positive. Having assignments submitted electronically allowed me as an instructor to hold an ongoing dialogue with my students; to develop a more interactive, personal relationship with them; to provide feedback to them as they completed their assignments; and to mentor them on various matters. Virtual office hours were thus "24-7," which students greatly appreciated. Throughout the semester, the students' comments on the assignments indicated an increasing confidence in their computer skills and their excitement over the power of the Internet for information-gathering. Their assignment reflections included the following:

- This assignment inspired me to think about how to include technology into my classroom. I think it is easier for me as a student teacher because I can start thinking of ways to integrate the Web, computer software, and email into my curriculum before I have my own students. By reviewing the math standards now, I can look for innovative ways to teach this information. For teachers that haven't incorporated technology into their curriculum, it is more difficult for them to either enhance or replace their existing materials. I'm excited about all the possibilities for using various technologies in the classroom. It is not only a more visually stimulating way to learn but it is also a necessity to be successful in this society.
- I am becoming more confident in myself in using the computer, and found that I don't have a feeling of dread in using technology in my classroom.
- I cannot believe the amount of useful information that is available through the Internet. The unlimited amount of resources have given me a sense of empowerment in teaching math in innovative ways.
- I would like to thank you for these interesting assignments you have given us. I don't know where else I would have found out all of these things that you can do on the computer
- I thought this lesson was a lot of fun to create. I didn't realize how useful the Internet could be for making math lessons, or any other lessons. I searched the Internet for different sites to incorporate into my lesson and I found these to be the most useful and easy to use for the lesson I created. After doing this lesson and all of the previous assignments, I am feeling much more comfortable using the Internet and e-mail. I look forward to trying to implement it into my classroom when I teach.

Postscript

This is the first semester that technology has been infused into CTET 121 in any significant way. Prior to this semester, I only had students surf the Web for Web sites that they felt would be useful for K-6 teachers. (They also gained experience with using calculator technology, using the TI Math Explorer to help develop mathematics concepts.) Hence, the planning and implementation was time-consuming and involved much experimentation. In addition, organizing and responding in a timely fashion to all of the students' comments and papers electronically was quite a challenge! However, the many benefits to the students and the close relationships that were developed made the efforts worthwhile.

In the future, I plan to develop a course that incorporates more math-related software and one that is Web-enhanced, as many of my colleagues have done. Such a course will include threaded discussions, online calendars, chat rooms, online resources and lessons, and other elements of an interactive, vitual learning environment that helps students see the possibilities of how technology can, as David Thornburg has said, "prepare our students for their future, not for our past."

Sparkles and Blemishes: Integrating California's New Technology Competencies into a Fifth Year Secondary Credential Program–Susan Harris

Educational decision-makers in California are anxious to equip beginning teachers with all the skills and competencies necessary to be "successful" teachers. They need opportunities to learn about the social and psychological foundations of education and the generic teaching skills related to instructional planning and management. They need content knowledge as well as knowledge of content-appropriate pedagogical strategies. They need opportunities to apply what they are learning during an extended student teaching experience. Because they need specialized training to meet the needs of California's ethnically and linguistically diverse student population CLAD (Cross-cultural Language and Academic Development) competencies were added to the mix. Now we are asked to ensure that "candidates are able to use appropriate computer-based technology to facilitate the teaching and learning process" as well. Required competencies have been defined in a developmental sequence which assumes that some basic skills would be acquired prior to admission, and that other more sophisticated competencies would be developed after initial credentialing. Nevertheless, at the basic credential level we are left with a very substantial number of competencies which are to be integrated into a teacher preparation curriculum which is already bursting at the seams.

This case describes my attempt to pilot integration of selected competencies (*general* or *specific*) in a secondary general methods course taken prior currently with initial student teaching. To organize this discussion, I have provided the competency, followed by piloted strategies for implementation. The case concludes with a discussion of "sparkles and blemishes" I encountered during this effort

Guidelines require that, prior to issuance of the Preliminary Credential, *each candidate demonstrates knowledge and understanding of the appropriate use of computer-based technology in teaching and learning.* To document achievement of this *general* competency my students developed: (a) web-based lessons which stressed higher-order thinking skills and caused students to use information not easily available from other sources; (b) lessons to teach secondary students to evaluate web resources; and (c) lessons which required middle or high school students to use HyperStudio to demonstrate their learning. They completed and reflected upon an Internet tutorial on Visual Literacy and used related principle when developing student handouts, transparencies, and other course materials. They used computer-based technologies to prepare all course assignments including a professional portfolio. While they all successfully completed the technical requirements for these assignments, few were able to actually teach and reflect upon the success of the lesson so questions of "appropriate use" remained unanswered. Would it work with "real" kids? Would students achieve the desired learning outcomes? Important issues were also raised: What reality should they design lessons for, the ideal or the real? Is it appropriate to design lessons for students which will not be taught either because the necessary hardware/software does not exist or because the school/department priorities dictate otherwise? Should a cooperating teacher be excluded from having a student teacher because s/he has few, if any, technology resources for teaching, or is lacking the skill to model effective use of what does exist, even though s/he is an excellent model in other respects? Clearly these are important questions which need answers.

This first "specific" competency addressed requires that *each candidate uses computers to communicate through printed media.* This was a fairly easy competency to achieve, as students were already required to prepare assignments using wordprocessing or other appropriate computer programs. Specific assignments included computer generation of a student handout and preparation of an overhead transparency (or PowerPoint slide) which incorporated text and supporting graphics. Scanners, digital cameras, and the Internet were used to "capture" images for inclusion in curriculum materials. They created an AUP (Acceptable Use Policy) to guide

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student Internet use in their classrooms. Finally, students used Excel to chart, analyze and present student test data. While students found the content of some assignments to be challenging, student valued the utility of application programs and most were sufficiently skilled so that actual preparation was fairly easy.

The third specific competency, *each candidate examines a variety of current educational digital media and uses established selection criteria to evaluate materials,* was also easy to address but addressing a related standard, *each candidate chooses software for its relevance, effectiveness, alignment with content standards, and value added to student learning,* was much more challenging. To demonstrate these competencies, students evaluated selected digital media, including web sites, and reflected upon appropriate criteria for evaluating different media. While I could and did require students to include an annotated bibliography of technology resources in interdisciplinary units, there was no assurance these materials would be available to teach the unit. In most, if not all cases, good content/topic specific software at an appropriate academic level was not available for my students to review or to use in their student teaching. Another thing disturbed me as well. Too many students maintained that real teachers would not go to such trouble in evaluating curriculum materials. This belief apparently was supported by many cooperating teachers. It is true that many teachers do not really evaluate materials they order. It is also true that thousands of dollars are wasted because they later discover that these materials do not meet their needs, or that they lack the proper hardware to use the media ordered. Again, there is a good bit of tension between the real and the ideal in terms of student and teacher perceptions.

Integrating the next standard, *each candidate is familiar with a variety of computer-based collaborative tools,* was also a challenge for me. I required that all students obtain e-mail accounts and many students did communicate by e-mail with each other or with me but their willingness to do so was dependent upon having access at home. While some did, many did not. As a class we participated in an "on line" video conference with a local superintendent of schools. Students were thrilled to have their questions answered "on line" but most felt the conference was slow and somewhat boring. While they saw the potential in having virtual guest speakers visit their classes they tended to believe that maintaining student attention would be problematic. They did recognize, however, that involving their students in such a conference might be a useful strategy for encouraging them to read and write. The examples and opportunities I provided were not sufficient to convince my students that these tools would be particularly valuable in helping their students learn. I need to try some new strategies. *I* need to see it work in a real classroom.

Integration of the last two standards, *each candidate demonstrates an ability to create and maintain effective learning environments when using computer-based technology,* and *each candidate analyzes best practices and research findings on the use of technology and designs lessons accordingly,* was also problematic. I could not require that student implement lessons using technology in their student teaching assignments (although ultimately this seems the only way to demonstrate achievement of this standard). I did, however, model lessons with them that required cooperative and collaborative strategies while using technology applications. We also explored how technology could/should be used for supporting the learning of Second Language Learners and considered how technology could support implementation of SDAIE (Specially Designed Academic Instruction in English) strategies. I am not at all convinced that students know what "best practice" is in their specific discipline or as applied to the learning of specific students. I am not sure I know. I even wonder if we have an adequate research base to guide their choices.

To summarize, my students and I accomplished a lot this semester. First the sparkles. They became more knowledgeable about and proficient using a variety of technological resources. They learned to access valuable resources on the Net and recognized potential classroom uses. They identified "increasing computer skills and competencies" as being an important goal for their own professional development. And now the blemishes. The additional demands placed on them to integrate technology into assignments created considerable stress and a negative attitude for some students. While they appreciate that technology *might* enhance their teaching and their students' learning, they are cynical about the reality. Few are convinced that integration of technology with their students in their subject area is viable. Two assignments in another credential course reinforced this view. They were to interview an instructional leader at a local school site regarding availability and use of technology for instruction; they were also to observe a teacher in their content area effectively using technology to help students meet subject matter standards. The results were dismal. Most principals had only limited knowledge of how computers were being used in their buildings; most could not suggest a technology-using teacher to observe. Few students were able to locate good models of teachers using technology within their subject area.

Technology standards require that students be placed in field experiences with teachers who are modeling such skills. I wonder where we will find them! Piloting technology integration was stressful for me as well. I have more questions than answers. Integration requires that all faculty participate. I wonder how we will encourage them to do so, and who will provide the resources necessary for them to do a first class job. Yes, in the best of worlds, beginning teachers should know how to use appropriate computer-based technologies to facilitate the teaching-learning process. I just wonder if we should expect them to do everything at once.

CalStateTEACH: An Integrated Curriculum Approach Empowering Teachers in Training through Technology–Jean M. Casey

A somewhat different approach to integrating technology into a teacher preparation is CalStateTEACH. CalStateTEACH is a new alternative path to the California Multiple Subject teaching credential with a CLAD (Cross-cultural, Language and Academic Development) emphasis. It is an 18-month program that culminates in a preliminary credential and 39 semester units of credit. The CalState TEACH approach is field-based, learner-centered, outcome driven, and is built around a set of activities and organized study that relies heavily on the school site as a learning environment. Technology is used to build an electronic community of support for the Intern as well as give them appropriate experiences to use technology successfully in their classrooms.

CalStateTEACH model

In the Cal StateTEACH approach, intern students do not have to attend classes at the university. They are in cohort groups of 20 and each group has a Learning Support University faculty member who visits their classroom monthly and communicates daily with them via e-mail and the Internet. They also have an Adjunct Site Faculty (a classroom teacher with at least 3 years of teaching experience) as a mentor at their school. They receive a kit of videos, texts, and software as well as complete Study Guides for the program. Upon successful completion of the program they receive a preliminary California State Credential.

Districts with Emergency Permit teachers in the CalStateTEACH program have certain commitments, including:

- Inform emergency teachers; show the program Overview video, and distribute applications
- Sign the Terms of Agreement with the university
- Identify Adjunct Site Faculty support teachers at each school site to work with the Intern Teacher(s) and university faculty member

Students in the first cohort 1A started the program September 7, 1999 with September 27,1999 being the last possible date to enroll for fall 1999. Cohort 1B will begin in January, 2000. The earlier participants apply, the more help we can give them toward passing their MSAT before school begins.

Curriculum

The curriculum is unique in that it is an integrated, spiral curriculum progressing in four stages. The first stage is 15 weeks, stage two is 17 weeks, stage three is 17 weeks, and stage four is 23 weeks. Vacations and breaks are interspersed throughout the program. The curriculum includes the normal Multiple Subject credential coursework plus the infusion of CLAD, mainstreaming, and technology curriculum.

The heart of the CalStateTEACH approach is its high quality academic and student support material using a variety of media. The quality curriculum, designed by 30 distinguished teacher educators in the California State University system, includes videos of the best mentor teachers in the nation, the latest texts, CD-ROM, cassettes, and access to university experts via the Internet. Students can study at the place and time of their choice, but not at their own pace. Students are guided and supported by an extensive instructional support system provided by faculty members who work with a small group of students in personal meetings and visits, in small groups, and on-line.

Features & Benefits

There are several features and benefits to the CalStateTEACH that make it particularly appropriate for teachers working with an Emergency Permit.

- The Emergency Permit teacher does not have to spend time driving to a university in the evenings.
- Most assignments pertain directly to the emergency or Intern teacher's classroom.
- Emergency teachers communicate using e-mail, the Internet, and online discussion groups.
- One university faculty member, who visits Interns at their school, conducts Saturday workshops and tailors the 18-month program to meet specific classroom needs.

Specifications

The high standards of this program have been approved by the California Commission on Teacher Credentialing. To complete the credential program, the Intern teacher will need a B.A.or B.S. degree; pass the CBEST and MSAT tests, and pass the summative assessment in all four stages of the program. Just because they are employed on an emergency credential does not mean that the participant will successfully complete this program. Program assessments help insure quality teachers.

Technology in the Teacher Education Classroom: Six Categories of Practice

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Abstract: Technology has the potential to make teacher education a more robust enterprise but not because we learn to make a Web page or use *WebCT* or create spreadsheets. Its potential for our practice lies in understanding the ways in which technology can solve our problems - the ways in which it can help us resolve the conundrum posed by the often competing need to meet standards, promote new notions of learning and teaching, and use technology. This paper discusses five categories of technology practice that solve teacher educators' problems by: 1.) helping students prepare for class, 2.) supporting students' grasp of concepts through collaborative meaning-making, 3.) publishing and sharing insights, 4.) promoting resource-based problem-solving, and 5.) modeling how theory translates into practice. Descriptions of each category are presented.

Teacher educators are challenged by a conundrum. Their students, perspective teachers, must be prepared to enter practice able to cope with the complex dynamic of state standards (often accompanied by high-stacks testing), new notions of learning and teaching (ones not part of their own educational experience), and the press for teaching students about and with technology. Practicing teachers who return to higher education classrooms often do so because they seek to resolve the pressures of coping with these seeming contradictions. Teacher educators are not immune to the pressures of these competing challenges either for they too are asked to meet standards or competencies mandated by state legislatures and professional organizations while helping their students understand and put into practice emerging knowledge. And, they too are encouraged and/or required to make technology a part of their practice.

There is a pervasive national notion that somehow technology has the potential to improve education - to solve instructional demands. Yet, higher education's response to that notion is all too often expressed as the need to put syllabi on the Web, to beef up presentations with PowerPoint, or to deliver courses on-line. Thus, university faculty, in general, and teacher educators, in particular, ask or are asked how to make a *PowerPoint* presentation, how to create a Web page, or how to use *WebCT* or *TownHall*. Yet, these are the wrong questions. Rather, before we seek information on how to use these and other technologies, we ought to be asking: What are the educational problems that technology might help solve?

The Problem is Recognizing the Problem

Educators have traditionally adopted tools and strategies, writes Cuban (1986), only when those tools meet the challenges and problems they encounter, not because someone says to use that tool (Cuban, 1986). The criteria educators use relates not to available technology but to the problems they perceive as they seek to meet educational mandates. Thus, when the mandate for education is perceived as the need to get a batch of students to absorb certain knowledge and habits of practice in order to meet a set of standards and/or competencies, educators adopt strategies that enable them to teach a prescribed content and to show tangible evidence that students have performed satisfactorily. Educators have learned to ration their time and energy to cope with these demands and pass these practices to succeeding generations of educators. A collection of

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teaching practices has emerged as resilient, simple, and efficient solutions. Technologies, no matter how appealing or lauded, that do not serve these goals are quickly rejected.

So, for example, teaching the entire class at one time is an efficient and convenient use of an educator's time. Lecturing, recitation, seatwork, and homework drawn from texts are direct, uncomplicated ways of transmitting knowledge and directions to groups. The tools that educators add to their repertoire are ones that are simple, durable, flexible, and responsive to teacher-defined problems. A chalkboard becomes an integral component of classroom practice because it solves the problem of writing, erasing, and keeping material as well as the problem of providing ready and simultaneous access for all students. A textbook becomes an integral part of classroom practice because it solves other instructional problems. It is portable, compact, and durable. It can be read for hours or a few minutes, skimmed or read carefully. All students can be assigned the same sections to be mastered individually as well as independently of class time. It travels easily.

Projectors, radios, television, and especially computers do not easily solve these problems. They are sometimes scare, sometimes undependable. Educators are not always skilled at using them. They have few, if any, experiences seeing others use these tools to promote learning. Thus, writes Cuban (1986:59), for many educators, "the simplicity, versatility, and efficiency of those aids such as the textbook and chalkboard in coping with problems arising from the complicated realities of classroom instruction far exceed the limited benefits extracted from using machines."

Educators confronted with new technologies are thus inclined to do one of two things: reject a new technology or adapt that technology to serve already recognized problems. *PowerPoint* supports classroom and conference presentations. The Internet becomes one more source of information to which students can be referred when writing research papers. Databases are collections of library resources or student records. Email serves to support dialogue with colleagues or to support the student advising load. Study of the role of technology to support K-12 classroom instruction is relegated to a separate course, and teacher education proceeds much as it always has. These uses of technology support the teacher educator's work, but they do not challenge time honored instructional practices in the teacher preparation or graduate level education classroom.

Still, there are some educators who do use a variety of tools as part of their instructional repertoire. There are educators, for example, who believe that films, television, and Internet resources enhance textbook reading. There are educators who are deeply concerned over visual illiteracy and seek to use television to enhance critical viewing skills. There are educators who believe that using camcorders to produce video helps students understand not only content but the anatomy of the media. There are educators who believe that teaching students to express content understanding using desktop publishing and web page designs value these tools' capacity to help students structure and communicate their knowledge using multiple forms of representation and non-linear patterns. There are educators who view television, camcorders, and a variety of computer tools as vehicles to motivate student learning, to supply relevant and meaningful content, and promote students' ability to reason and solve problems. "In effect, the practical criteria these teachers use in deciding what is best for them and students are broader than ones used by their colleagues" (Cuban, 1986).

Technology as Part of the Teacher Education Classroom

If technology is to have a role in the teacher education classroom, and more importantly, if technology is to make learning to be a teacher a more robust experience, teacher educators must stop asking questions about technology and start focusing on the problems which challenge teacher education. The remainder of this paper addresses six problems that confront teacher education and the ways in which technology offers solutions.

Preparing for Class

In the teacher education classroom, time limitations are perhaps the educator's greatest challenge. Many teacher education classes meet only once a week. Others meet for one hour, three times a week. A class is generally bounded by either a ten week quarter or a sixteen-week semester, making contact time with students only 48 hours if no holidays interfere. This time is precious, and the broad agenda necessitated by the complex and robust array of competencies, standards, literature, and activities places extraordinary demands on this time. There just never seems to be enough. Certainly, students are expected to spend considerable time in preparation for class. Yet, that time generally focuses on independent research and reading. Occasionally, students can

Another group of students was asked to use *NetMeeting* (http://www.NetMeeting.com), an online writing tool, to create a reader's theater to demonstrate the debate between advocates of phonics and advocates of whole language prior to class. They presented these reader's theaters during the next class period. As students watched the performances, they were asked to note common threads and to look for discrepancies. Three, after reading Howard Gardner's *The Unschooled Mind* and discussing the book using email, students were challenged to invent a school, create a desktop published brochure, and a one minute video advertisement. As students and the instructor reviewed the materials, they looked for reflections of Gardner's ideas as well as aspects of the "school" which contradicted Gardner's ideas. There were many rigorous debates. Four, after reading Vygotsky's *Mind in Society*, students were challenged to use a graphics program to create a map of

Vygotsky's mind modeled after the maps in Hampton-Turner's *Maps of the Mind*. Five, after reading Gilster's *Digital Literacy* and participating in a threaded discussion using *TownHall*, students were asked to use graphics and word processing programs as well as a large piece of butcher paper and markers to redesign the book cover. Students were challenged to complete their redesign in such a way that educators would be encouraged to read the book and see the relationship between the book and their practice.

Resource-Based Problem Solving

There was a time in the life of teacher educators when our central problem was selecting the right textbook and identifying the appropriate body of knowledge that informed the topics of the courses we taught. Our work focused on using the library and keeping abreast of the textbooks and journals published in our field. Education seemed a relatively straightforward, clear-cut domain. We could anticipate that our students would enter classrooms where textbooks were available to teachers with teacher's manuals to guide their practice. But the world of information has changed, as has the complexity of teaching and learning. No longer is it clear exactly what knowledge students will need. Neither is it clear which resources will best structure their practice nor can we guarantee what problems they will encounter during their life as practitioners. Those entering teaching today must become problem solvers, and they must be able to solve those problems within the context of an ever-growing knowledge base. Teacher educators must find ways to help those entering practice and those currently practicing use the plethora of resources – online, offline, in their communities, and among their fellow educators. Today's teacher educators must ask: *How can we help students become resource-based problem solvers?*

Two examples will serve here to illustrate the ways in which technology can support resource-based problem solving. The first example rests on the work of Bernie Dodge (http://edweb.sdsu.edu/webquest/webquest.html). While it is clear that one important skill is the location of resources either using library databases or "surfing" the web, what is more important is using identified resources to solve problems. The WebQuest is an Internet based instructional strategy that sets a context, identifies a problem, clearly specifies an outcome or product, and provides links to resources necessary for solving the problem. While this strategy has become extraordinarily popular among K-12 educators, it has the potential to serve teacher educators as well. The author teaches an introductory course to Secondary Education licensure students called The Culture of Teaching. One of the important course topics focuses on the legal parameters surrounding educational practice. In addition, these students do not take a course in educational technology. Rather, technology is embedded throughout their coursework. A WebQuest was created to engage students with the ethical and legal issues associated with the attendance of AIDS students in high schools (http://mason.gmu.edu/~mballard/WebQuest.htm). This WebQuest asked small groups of students to create an "AIDS policy" for their school. Links were provided to legal sites, sample policies from other schools, and to sites containing medical information about AIDS. After students had completed their policies and shared them with other groups, groups of four students were presented with other legal issues related to such areas as special education and discipline. They created their own WebQuest, locating both text and Internet resources. Classmates then solved each others' WebQuests. In this way, it was possible to help students explore the legal issues associated with teaching and to teach them about the WebQuest as an instructional strategy.

A second example of resource-based problem solving is a graduate course created by Evelyn Jacob. The course, Education and Culture, is designed around a Cultural Inquiry Process (CIP). In teaching the course, Jacob and Ruess (In Press) had identified two problems. One, since the body of relevant cultural research was not organized around addressing practitioner's puzzlements, it was necessary to "cover" much research before practitioners had sufficient information to use the CIP in their own practice. Second, although post-course interviews supported the content of the course, students expressed a need for support to continue using the CIP. Jacob and Ruess created a course web site (http://classweb.gmu.edu/classweb/cip/index.htm). This web site presents the six steps of the CIP and, for each step, provides links to information supporting each step, research related to using cultural perspectives to develop educational interventions, and sample CIP Cases. Additionally, a mechanism is provided for small groups of students to support each other in implementing the process and in seeing a variety of potential perspectives related to individual puzzlements. Students who have finished the course are encouraged to return to the site, using both the text and interpersonal resources of the site to solve their instructional problems.

Publishing and Sharing Insights

In the traditional teacher education class, knowledge resides with the instructor. The purpose of the class is to transmit the instructor's knowledge to students. Student knowledge is tested by objective tests, research papers, and various other, generally written, assignments. The flow of learning is from the instructor to the whole class and back to the instructor, student by student. Decisions about appropriate instructional strategies and technology use, in particular, center on supporting this flow. Instructors solve teaching problems by choosing lectures sometimes supported by *PowerPoint* presentations, projected Internet sites, and notes or diagrams on chalkboards. Instructors additionally ask students to respond with written tests, prepared presentations, and research papers. Sometimes student work is supported by word processors and Internet references. If, however, the teacher education classroom is to honor students as teachers and teachers as students as well as the social construction of knowledge, the flow of learning from the instructor to students and individual students to the instructor must be reframed. The problem facing teacher educators is not how to support this flow but, rather, *how can the flow of learning be shifted from instructors to students toward students, supported by instructors, creating, publishing, and sharing insights?*

Secondary education students completed a field experience, shadowing a high school student for a day. When they returned to class, they were asked to divide into groups of three and challenged to reflect on their field experience, identifying five generalizations about the school lives of high school students. They then created a five slide, *PowerPoint* presentation – one for each generalization. Instead of presenting their slides to the class, groups rotated around the room, examining each others' presentations and noting similarities and differences. A final list of generalizations was created by the class and posted. Each week as students and the instructor explored high school students' development and learning, they returned to the generalizations to see if they could further elaborate meanings and explanations associated with their observations. Their midterm exam centered on returning to their original *PowerPoint* presentation and building links from each slide to student generate explanations, text-based resources, and Internet sites. Most groups added additional generalizations that their continued learning experiences demanded. In this way, technology supported the shift from the instructor as the holder of knowledge to students as creators and elaborators of their own knowledge.

The final examination for a graduate cohort studying technology and learning was structured so that assessment was not based on individuals demonstrating mastery of the course content but, rather, on students collaborating to apply their knowledge to the creation and publishing of a learning product that reflected the principles they had studied. Together, students analyzed the commercial product, *Hooked on Phonics*, including a copy of one of the *Hooked on Phonics* television commercials. The product was discussed in terms of the learning philosophy underlying the product's design as well as the design of the box and promotional materials. Students were randomly assigned to groups of four and challenged to create the perfect educational software program, reflecting the ideas and theories they had encountered during the course. Among the many tools that supported students were graphics programs, word processors, glue, and colored pencils. The final product was to be the software's packaging and a desktop published brochure explaining the power of the software. Groups switched finished products and used word processors to write a comprehensive analysis of the ways in which the product reflected learning principles as well as to point out conflicts with theories or to recommend elaborations.

Modeling Theory to Practice

The most powerful model of teaching for teachers comes from their own experiences as learners. Thus, if one's learning experience happens only in a teacher-centered, print-based classroom, one is likely to teach in that way. If teacher educators perpetuate that learning experience, the traditional image of instruction persists and is reinforced. If we, as teacher educators, use technology only to give better lectures or as additional sources of literature for research papers, perspective and continuing teachers will have no better image of the role of technology for teaching and learning. If, however, teacher educators seek to identify and understand newer instructional problems and then choose to use technology in ways that solve those problems, they offer perspective and continuing teachers images of both new instructional problems and new uses of technology. In all of the examples above, technology use did not focus on the "hows" of using technology. Neither did it focus on modeling the use of technology within the K-12 curriculum. Rather, technology was used to support students' own learning. It was used to solve authentic teaching and learning problems.

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Second, using technology to address the problems of supporting preparation for class, assisting students to grasp concepts and collaboratively create meaning, promoting resource-based problem solving, and creating, publishing, and sharing insights represent solutions to teaching problems reflect newer understandings of learning that are constructivist, social, and distributed. They reflect instructional choices that not only use technology to support learning but convey an alternative version of teaching and learning. Teacher educators must be careful not to talk one talk and walk a different walk. They must be careful not to advocate a particular vision of teaching and learning while practicing a different vision. Using technology to solve the problems described above allows teacher educators to solve the last problem – modeling theory to practice.

Conclusion

Cuban (1986) characterizes education's history with technology as proceeding through four phases: enthusiasm, scientific research, disillusionment, and teacher bashing. As teacher educators, we have experienced and sometimes contributed to the enthusiasm for the electronic technologies. We are cognizant of and have contributed to the research associated with technology. Yet, our slowness to use technology to support our own teaching – promoting technology by word more than deed – has made it difficult for entering and continuing teachers to use technology to support their own teaching. Today's disillusionment with technology centers not only on problems of access, maintenance, and cost but jeopardizes efforts to realize the potential of technology. Some have begun to question technology's role in education, citing teachers' lack of use. Policy makers have begun to lean toward such technology applications as large, integrated learning systems and teacher-proof, "how to" curriculums. Teacher educators have the responsibility to carefully rethink instruction, identify relevant problems, and find ways to solve those problems by making wise use of technology and conveying a vision of educational practice consistent with newer understandings about teaching and learning.

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Videos in Technology Integration (VITI): A Multimedia CD-ROM

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Abstract: This paper is a report the on the rationale, design, development, and evaluation of *Videos in Technology Integration* (*VITI*), a video-case based, multimedia CD-ROM intended to provide teacher educators with concrete examples of exemplary technology integration. A review of literature shows that it is important that exemplary models of technology integration be incorporated into teacher education programs. However, video-case methodology specific to the area of teacher educators' technology integration had not been addressed. Inspired by the dedication to help teacher educators meaningfully integrate technology into their classrooms, the CD-ROM is an initiative in modeling exemplary technology.

Introduction

The Center for Technology in Learning and Teaching (CTLT), located in Iowa State University's College of Education, is dedicated to helping educators provide students with technology-enriched environments that enhance learning at all levels. In keeping with this commitment, *Videos in Technology Integration* (*VITI*), is a video-case based, multimedia CD-ROM designed to provide higher education instructors with concrete examples of exemplary technology integration.

Background/Purpose

Although the potential for technology use in teacher education programs is strong, few models exist for teacher educators who desire to use technology to facilitate learner-centered environments. As a result, many teacher educators who would like to integrate technology into the learning environment lack the knowledge to do so. Ultimately, such a lack of knowledge on the higher education level results in a lack of and/or ineffective integration of technology in the K-12 classroom. Because effective and appropriate technology use is not demonstrated for pre-service teachers, many lack the knowledge to effectively use technology to create a learner-centered environment. Therefore, it is important that we incorporate exemplary models of technology integration into teacher education programs.

While teacher educators who desire to use technology to facilitate learner-centered environments would benefit from models of exemplary technology integration, they possess such divergent backgrounds and expertise that traditional staff development does not meet the needs of all involved. To address the complexity of modeling technology-integrated learning environments for teacher educators, current research in instructional design suggests using video-case methodology.

The video-case methodology was inspired by the North Central Regional Education Laboratory's (NCREL) *Learning with Technology*, which features video and written cases designed to help teacher educators reflect and facilitate discussions on uses of technology in their classrooms. Furthermore, such methodology has been used extensively for professional preparation in business, medicine, and law (Hasslebring, 1994) and is equally, if not more, appropriate for teacher educators due to their expressed need to connect to real classroom environments. The video component provides a rich environment where participants observe the uses of technology and the effects it has on students and the teacher. The hypermedia component, which consists of linking text, graphic art, sound, and video, allows the user to control when and how these elements are delivered.

The video-case methodology, presented in CD-ROM form, allows anchored instruction, which provides a situation in which users share a common experience (Hasslebring, 1994). Within this shared experience, the user is able to reflect and develop his/her own meaning contingent on past experiences and ultimately transfer the learning to new and developing situations in his/her classroom environment.

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A review of literature (Office of Technology Assessment 1995) indicates that video-case methodology specific to the area of teacher educators' technology integration has not been designed, developed, implemented and evaluated. Therefore, the purpose of this project was to create a multimedia CD-ROM that incorporates video cases featuring exemplary technology integration by teacher educators to be used by teacher educators.

The context of this paper includes a description of the design process, the CD-ROM, and the status of a preliminary summative evaluation.

Methods (The Design Process)

To complete the study, a multimedia research team was assembled. The research team consisted of higher education faculty, graduate students, and pre-service teachers of various ages, gender, ethnicity, and socio-economic background. The diversity of the research team assisted cross-validation among data sources, data collection, time periods, and theoretical schemes. The team members volunteered their participation according to their interests in and/or connection to technology integration in the classroom. For example, most of the higher education faculty participants had expressed the need for such a modeling program because of their past experiences with technology integration. Due to their participation in a mentoring program (Thompson, Schmidt, & Hadjiyianni, 1995), these faculty members were able to gain knowledge of appropriate and effective technology integration into their classrooms, and as a result, now serve as the subjects featured in Videos in Technology Integration. Other participants involved in constructing the CD-ROM had a background in the areas of video photography, instructional design, and research methods.

The research team conducted structured interviews and observations of faculty members who exemplified model technology integration to gain perspectives of teacher educators on technology integrated learning environments. The selection of featured faculty members was determined by their reputation for technology integration in their teaching.

The selected faculty participants (previously described) of the video case multimedia project were video taped in their technology integrated classrooms. The video showcased the faculty participants, the classroom set-up, and the administered lesson. The collected video footage was then edited into vignettes to make up the major component of the multimedia program. The editing was done through Adobe Premiere. The video was edited and categorized into peer debriefings, interviews, reflections, mentoring, and information on relevant reference materials. Then, the vignettes were labeled and assembled in a way that would allow the viewer to gain an understanding of how technology is integrated to facilitate a learner centered environment. Ultimately, the vignettes, linking text, graphic art, and sound were comprised into a user-friendly multimedia program using Authorware and burned onto a CD-ROM.

The CD-ROM

The CD-ROM, entitled Videos in Technology Integration (VITI), features a total of nineteen video vignettes highlighting technology-integrated lessons, and instructor and student interviews. Menu bar buttons and clickable text allow the user to navigate through the multimedia program. Current features include:

- a concept/navigation map that allows the user to have an overview of the product's totality
- an introduction/welcome that contextualizes the program by giving background, purpose, and general description
- a list of the featured content areas
- titles of the featured video vignettes and their descriptions
- video vignettes featuring exemplary technology integration

Currently, the program has three major content areas: Math with Anchored Instruction: The Jasper Woodbury Series; Math with Distance Education: The Iowa Communications Network; and Reading and Language Arts with PowerBooks. Users can access the video vignettes by selecting a content area and then clicking on a video vignette title. The titles are worded in the form of questions that might be common among users.

Math with Anchored Instruction: The Jasper Woodbury Series
What is the Jasper Woodbury Series?

Why would I use this?
How does it support learning?
How could I use this?
What are the strengths and challenges?
How do students respond?

Math with Distance Education: The Iowa Communications Network
What is the ICN? Iowa Communications Network
Who uses the ICN?
How might I benefit?
How might students benefit?
How do students respond?

Reading and Language Arts with PowerBooks.
Why use Powerbooks?
Who uses them in class?
What should I know?
How does it support learning?
What are the strengths and challenges?
What are the students' responsibilities?
How do students respond?

The question formatted titles contextualize the content, prompt users to discuss issues surrounding technology integration, and act as navigational tools and cohesive elements that allow the vignettes, collectively, to tell a story. When users select a vignette, they are guided through the video by a higher education instructor whose narration addresses the question embedded in the vignette title.

The CD-ROM is formatted for Macintosh. The recommended minimum configuration is Power Mac, System 7.5 or higher, 16 MB RAM, thousands of colors, monitor resolution of 800 X 600 or higher, 2X CD-ROM drive, and Quicktime 3.0. No installation is necessary. To run the CD, the user can simply place CD-ROM in the CD-ROM drive and double-click on the *VITI* icon.

Preliminary Results

In Spring 1999, the current version of the CD-ROM was assessed by twenty-five faculty members of the Iowa Association of Colleges of Teacher Education (IACTE) via the Iowa Communications Network (ICN) as an anchor of the Videos in Technology Integration Iowa Discussion. The Iowa Discussions through the ICN was aimed at fostering conversation and interaction between Colleges of Education in the state of Iowa. Topics of discussion included: uses of video cases in teacher education; the current state of technology use in teacher education programs in the state of Iowa; and visions of future possibilities of technology in teacher education. The institutions represented were University of Iowa, University of Northern Iowa, Iowa Wesleyan, St. Ambrose, Graceland, Clark, Grinnell, Upper Iowa University, Loras, William Penn, Dordt, Central, Drake and Simpson (Long, S. & Thompson, E. A., 1999)

In addition to taking part in ICN sessions, involvement in the Iowa Discussions consisted of reviewing the CD-ROM and completing a survey. The surveys were aimed at gathering information about teacher educator's beliefs about technology and teacher education and those of their institutions, and their reactions to the CD-ROM. Participating faculty members received the CD-ROM either via the IACTE conference or by mail (Long, S. & Thompson, E. A., 1999).

While the ICN sessions were successful, currently, the analysis of surveys is in its preliminary stages (Long, S. & Thompson, E. A., 1999).

Implications

While the CD-ROM features a number of video vignettes, the CTLT hopes that *VITI* will continue to grow and evolve, collecting more video of exemplary technology integration and spanning across many more content areas.

In conclusion, because no policies for continuing educators' knowledge of technology integration have been predetermined, educators are finding themselves ill-prepared to ready students for the "real world" in which technology plays a major role. Therefore, the preliminary results of the project are significant. The program has potential for widespread impact on classroom technology integration, and can be useful to educators and policy makers. It is our hope that ultimately the multimedia program will have a sequential effect on classroom technology integration. The program can serve as a model for teacher educators who can in turn model exemplary technology integration to their pre-service students. These students can, subsequently, effectively and efficiently integrate technology into their K-12 classrooms.

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Preparing Tomorrow's Teachers Today: Using Videos of Technology-Using Teachers to Enhance Pre-Service Teachers' Technology Skills

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Abstract: This paper describes the development of CD-based video clips and case histories to be used in a course in instructional technology. The videos illustrate real K-12 teachers using technology in real teaching situations. The video clips and case histories are used to help preservice teachers better conceptualize how to use technology as a learning tool. The process of video development and use of the videos in teaching is described. Initial student reaction to the videos has been positive.

Tomorrow's technology-enhanced schools will require that teachers be prepared to use and integrate digital instructional technologies (DIT). National and local standards, such as the National Mathematics Education Standards (National Council of Teachers of Mathematics 1989) and the National Science Education Standards (National Research Council, 1996), require that preservice teachers learn how to use technology effectively as learning tools in teaching. Currently, the lack of real-world classroom models that use DIT as learning tools for instruction inhibits beginning and advanced students from implementing digital technology effectively into instruction. Preservice teachers come from classrooms in which they have used DIT mostly for low level educational purposes such as drill and word processing. Thus, few preservice teachers come to college with experiences or schemata that allow them to conceptualize how to teach effectively using DIT.

The Course

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At Iowa State University, preservice teachers take CI 201, Introduction to Instructional Technology typically as sophomores and before they have completed teaching method courses or teaching practica. CI 201 teaches basic technology skills in the context of using the technology as a teacher and encourages preservice teachers to incorporate technology as learning tools in the future teaching. We currently use the Grabe and Grabe (1998) Instructional Technology Book and emphasize the Grabes' ACTIVE model in the course. The Active Model argues that technology should be used in a manner such that the learning tasks are:

- *Active* - tasks require cogntive behaviors that emphasize the transformation of information into personal knowledge,
- *Cooperative* - tasks require meaningful interaction among students,
- *Theme-based* - tasks are flexible and multidisciplinary based on an organizing theme,
- *Integrated* - tasks emphasize content area knowledge and use technology tools to encourage learning this content in ways that are meaningful, and
- *Versatile* - tasks make efficient use of technology skills and develop those that can be applied repeatedly.
- *Evaluation* - Finally, evaluation tasks allow the assessment of the student's ability to *use* the knowledge and skills we want them to learn

By emphasizing the use of technology for learning tools and the ACTIVE model, we hope to lead future teachers towards constructivist uses of technology that promote knowledge development that is meaningful and transfers to new situations.

CI 201 is a large course. Two sections of 150 students meet twice a week for lecture and once a week for a 3 hour lab. Departmental faculty teams provide the lectures and teaching assistants working under the direction of the course lecturers teach the laboratories. Most of the student assignments in the course ask the preservice teachers to demonstrate use of technology skills by using those skills to create technology-based lesson that they will use with their future students. Throughout this course, preservice teachers design and develop technology-based lessons and projects targeted to the specific classroom situations in which they intend to teach.

We schedule CI201 early in the preservice teaching sequence to provide students with technological skills that can be used in later methods, technology, and practica courses. This early exposure to a technology in teaching course compounds our students' difficulties in developing models of effective technology use in education. Most students have not yet begun to think about themselves as teachers and they have not yet incorporated contemporary teaching models into their thinking. This lack of prior experience and teaching knowledge makes it difficult for them to conceptualize and imagine effective learning-tool teaching uses for technology that they can incorporate in their own teaching.

The Videos

To address this issue, we have begun to develop videos of exemplary uses of technology in real classrooms. Funding provided by ISU has allowed us to videotape teachers in Iowa who are using technology effectively as learning tools for their students. Modeling is known to be an effective method of teaching (Pressley & McCormick 1995). According to the report, *Teachers & Technology: Making the Connection*, "Video can extend the range of student observation into the classrooms with the best teachers, wherever they are located. Whether live broadcasts from a classroom or tape, they can provide teacher education students with models of effective teaching and the opportunity for reflection on what constitutes good teaching" (Office of Technology Assessment, 1995, p. 166). The videos developed in this project present our preservice teachers with authentic PreK-12 learning situations that integrate technology.

Our project had one overriding goal: To develop a collection of digital video segments to be used in teacher education courses, primarily CI 201, that exemplify PreK-12 classroom situations in which teachers and students effectively use DIT as learning tools. These videos show PreK-12 students using technology; and include interviews with teachers and students describing their uses of technology for learning and teaching. The interviews ground the teaching situation in a meaningful context. The teacher is asked about the overall place of the videotaped activities in the overall curriculum and about the goals and purposes of the lesson and the technology activities. Interviews with the teachers' students present the students' conceptualizations and reactions to the learning situation including the use of technology.

Two types of uses for the videos are planned and partially implemented. One use is to prepare short segments on CD that can be used in a large class to illustrate particular points. The second use is to provide students with longer video cases on CD that would be used as part of outside of class case history or problem-based assignments. Both the nature of the videos and the uses we plan and are implementing are different from the standard videotapes commercially available and their typical use. Commercial tapes are typically long sequences that tell a cohesive story. They often relate tangentially to the specific goals of a given lesson. Rarely can an instructor use a video to present several short examples of a particular teaching approach or concept. In their typical use, the content as discussed in class is often distant in time from the examples provided in the tape. Instructors may show a video to introduce a unit that may last for several class periods. Students are expected to remember the examples in the video as they encounter the concepts and schemata taught in the unit. This elapsed time weakens the instructional effectiveness of commercial videos.

As conceptualized, the proposed videos would include both longer sequences and short, specific examples aligned directly with specific course concepts that can then be integrated into a lecture or class discussion. For example, given appropriate videos, an instructor could illustrate a discussion of the pedagogical value of using a hypermedia program to produce collaborative reports with:

- a short (2-5 minute) sequences showing a 3rd grade team in the process of developing a social studies hypermedia project, and
- a middle school math class creating a hypermedia report involving graphics and algebraic prediction equations based on a water quality study they have done in their local environment,
- a high school English classes hypermedia project on major authors and works of the cultures of the students in the class.

These multiple examples would be timely to the on-going discussion. They would provide students with models appropriate to their intended teaching level. Presenting multiple examples of to be learned concepts and schemata facilitates learning (Andre 1997). Providing models with which students can readily identify also facilitates learning (Pressley and McCormick 1995). Thus, this use of video segments should help preservice teachers better understanding effective technology integration into teaching processes and strategies. Such a use of technology would provide just-in-time instruction to support preservice teacher learning.

Learning would also be reinforced through the case examples provided to students on CD. These case histories would contain multiple segments of video that would cover more completely a whole unit involving technology. The segments would contain examples of students using the technology, interviews with students about their use, interviews with the teacher explain the goals and purposes of the unit, interviews with the students about their overall reactions to the unit, and examples of student produced materials. As part of laboratory and take-home assignments, preservice teachers would be asked to review and analyze the case. The preservice teacher would be expected to identify strong and improveable points, to suggest revisions in the unit, and to consider how the approach might be adapted to his or her own teaching. Discussion time in laboratory sections would allow students to present their case analyses. Our plan for producing video cases, described below, would provide multiple examples across grade levels of learning tool uses of technology. Having example cases closely related to the preservice teacher's intended grade level and subject matter facilitates the effectiveness of the cases.

Video Development

To develop the videos, we contacted teachers and administrators and located a cadre of teachers spanning PreK-12 grades who were willing to participate in these videotaped cases. Permission to video and release for future use of the videos for teaching purposes was obtained from school district personnel, parents of students in classrooms being videotaped, and the participating students where this was an age appropriate question. Four specific topics of instructional technology use in classrooms were targeted:

1) PreK-12 student use of the World Wide Web for research, project development and computer mediated communication, and Web page development tools;
2) PreK-12 student production of hypermedia projects;
3) PreK-12 student use of integrated software programs (i.e., desktop publishing, databases, spreadsheets) for interdisciplinary research and writing projects; and
4) PreK-12 student use of software to develop problem solving and critical thinking skills.

Specific grade levels (e.g., early childhood education, elementary, middle, and secondary education) were targeted in each of the four targeted topics for video development. Approximately 1 academic year was spent in collecting the original video samples. A digital video camera was used to create the videos. These original videos were reviewed by the senior faculty and graduate students involved in the project and segments were identified for editing into the videos to be used in CI201.

As noted, two types of edited sequences were identified. The first consists of relatively short sequences (several seconds to a few minutes) that illustrate particular teaching points. These shorter sequences will be used in lecture to illustrate effective technology uses. In some cases, these shorter sequences were combined into a video case history. Students in CI201 will analyze these case history as part of laboratory or homework assignments. Both the shorter examples and the video cases will be prepared on CDROM and made available to students in the course.

The following paragraphs describe two of the instructional activities that have been videotaped in classrooms.

- Second grade students design and produce electronic portfolios using mPOWER with the assistance of 8th grade students enrolled in a multimedia development course. The purpose of the project is for the 2nd grade students to visually represent and document what they have learned in 2nd grade by producing a multimedia portfolio. This project involves 8th grade students who provide one-on-one instruction on how to use a multimedia program to elementary students. After receiving initial assistance from the 8th grade students, the 2nd graders work independently on their portfolio in their classroom for the rest of the school year. This collaborative multimedia development project supports the districts' learner outcomes in the areas of collaborative learners, responsible communicators and problem solvers.
- In a sixth grade language arts class, students work in collaborative groups as they plan and publish newsletters that document people and events during various decades of the 1900's. During this four-week instructional unit, each 6th grade student has 24-hour access to a portable laptop computer for gathering research, importing graphics and writing notes and articles for the newsletter. Video clips of this classroom showd students actively engaged in a learning activity where they are learning and applying language arts skills throughout the writing process.

Initial Use

Editing of the videos onto CD is proceeding. Initial uses of some of the videos clips provided informal support for the concepts. Preservice teacher reaction to these initial uses have been quite positive. Use of the videos is perceived by the preservice teachers to help them better conceptualize ways to effectively use technology in real teaching situations. In the presentation for SITE 2000, we will describe the development process in more detail and illustrate the available videos and CDs. In addition, student reactions to the use of the videos will be described.

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Using Videotape Technology as a Tool To Enhance the Transformation of Preservice Teachers Into Practicing Teachers

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ABSTRACT

Today, more than ever before, field experiences are an integral part of teacher preparation programs. As the accountability movement promoting performanced-based assessment grows, teacher educators are looking for opportunities to integrate real-life experiences into their programs. This article describes a videotaping program at the University of the Incarnate Word designed to provide accurate data to preservice teachers regarding their performance in an actual classroom settings. This videotape technology provides the opportunities that prospective teachers need to effectively reflect and assess their development toward mastery of state-mandated competencies.

Today, more than ever before, field experiences are an integral part of teacher preparation programs. These field experiences provide authentic contexts in which preservice teachers gain the knowledge and skills necessary to integrate theory with practice. It is believed that prospective teachers should learn to systematically observe, recognize, and practice teaching behaviors prior to entering the teaching profession. However, field experiences alone are inadequate for the transformation of preservice teachers into practicing teachers.

The importance of developing in new teachers the ability to self-assess and reflect on their practice of teaching is well documented in the literature (Koorland, Tuckman, Wallat, Long, Thomson, & Silverman, 1985; Moore, 1988; Struyk, 1991; Jensen, 1994; O'Donoghue, 1996; Holodick, Scappaticci, & Drazdowski, 1998). In addition, research clearly reveals that preservice teachers reflecting upon teaching can enhance their repertoire of pedagogical knowledge (Freiberg & Waxman, 1988). Reflection and self-assessment of teaching performance must accompany meaning field experiences in the schools for the continued growth of preservice teachers to occur.

In order for preservice teachers to effectively assess their own teaching, accurate data must be collected, analyzed, and interpreted. While data provided preservice teachers should come from a variety of sources, one tool for data collection is the use of videotaped teaching episodes to foster self-assessment and reflection. Since the videotape can be stopped, reversed, and fast-forwarded, it is possible for the preservice teacher to focus on specified aspects of the lesson. However, simply videotaping preservice teachers and having them assess their teaching performance without established structured procedures will be ineffective (Holosick, Scappaaticci, and Drazdowski, 1998).

State-Mandated Beginning Teacher Competencies

The State Board of Educator Certification (SBEC) was created in 1995 by the 74th Legislature to govern the standards of the education profession in Texas. In 1997, SBEC approved and adopted Teacher Proficiencies that reflect the skills and knowledge needed by beginning teachers to enhance student learning. In addition, SBEC developed competencies to reflect mastery of the Teacher Proficiencies and created state-mandated exams based on these competencies. These proficiencies, competencies, and exams are integrated into the teacher preparation program approval process in Texas. All teacher preparation entities are held accountable for the performance of educators who complete certification requirements from the entity.

A high priority in the University of the Incarnate Word (UIW) teacher preparation program is for our preservice teachers to meet the state-mandated competencies. Videotape technology, while not a new or innovative technology, has proven to be an effective tool to help our preservice teachers meet the competencies and make the transition from preservice teachers into practicing teachers.

Videotaping Program

Structured procedures and activities were established by the education faculty at the University of the Incarnate Word, utilizing videotape technology in field experiences throughout the teacher education program. These procedures and activities, used as benchmarks in the program, require preservice teachers to videotape a lesson in their field setting for two semesters prior to student teaching. Each semester, the student and faculty view the videotape and assess the student's teaching performance relative to the state-mandated competencies established for beginning teachers in Texas. These competencies, used by every teacher preparation program in Texas, are designed to ensure that new teachers have the knowledge and skills to teach in Texas public schools. The student is required to view the videotape, reflect on teaching behaviors, mark the professional development competencies observed in the lesson, and give an example of the behaviors illustrating the competencies listed in Table 1. At the end of the semester,

Professional Development Competencies

Domain I: Understanding Learners

O1: The teacher uses an understanding of human developmental processes to nurture student growth through developmentally appropriate instruction.

02: The teacher considers environmental factors that may affect learning in designing a supportive and responsive class- room community that promotes all students' learning and self-esteem.

03: The teacher appreciates human diversity, recognizing how diversity in the classroom and the community may affect learning and creating a classroom environment in which both the diversity of groups and the uniqueness of individuals are recognized and celebrated.

04: The teacher understands how learning occurs and can apply this understanding to design and implement effective instruction.

05: The teacher understands how motivation affects group and individual behavior and learning and can apply this understanding to promote student learning.

Domain II: Enhancing Student Achievement

06: The teacher uses planning processes to design outcome-oriented learning experiences that foster understanding and encourage self-directed thinking and learning in both individual and collaborative settings.

07: The teacher uses effective verbal, nonverbal, and media communication techniques to shape the classroom into a community of learners engaged in active inquiry, collaborative exploration, and supportive interactions.

08: The teacher uses a variety of instructional strategies and roles to facilitate learning and to help students become independent thinkers and problem solvers who use higher order thinking in the classroom and the real world.

09: The teacher uses a variety of instructional materials and resources (including human and technological resources) to support individual and group learning.

10: The teacher uses processes of informal and formal assessment to understand individual learners, monitor instructional effectiveness, and shape instruction.

011: The teacher structures and manages the learning environment to maintain a classroom climate that promotes the lifelong pursuit of learning and encourages cooperation, leadership, and mutual respect.

Domain III: Understanding the teaching environment

012: The teacher is a reflective practitioner who knows how to promote his or her own professional growth and can work cooperatively with other professionals in the system to create a school culture that enhances learning and encourages positive change.

013: The teacher knows how to foster strong school-home relationships that support student achievement of desired learning outcomes.

014: The teacher understands how the school relates to the larger community and knows strategies for making interactions between school and community mutually supportive and beneficial.

015: The teacher understands requirements, expectations, and constraints associated with teaching in Texas, and can apply this understanding in a variety of contexts.

Table 1: Professional Development Competencies
Texas Education Agency

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students are required to compare and contrast their two videotaped lessons, reflecting on ways to improve their instruction and make decisions accordingly. An education faculty member also views the videotape, marks the professional development competencies he/she observed in the lesson, and gives an example of the student's performance illustrating the competencies. A feedback conference is scheduled between the faculty member and the student to discuss the videotaped lesson relative to the state-mandated competencies.

Conclusion

Through the utilization of videotape technology, preservice teachers are able to use videotapes to record their performance in the classroom. This videotape can later be used for discussion and formative development. After viewing the videotapes and reflecting on their demonstration, prospective teachers begin to realize that improvement is always possible and indeed necessary, even in the best of circumstances.

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Preparing Technology-Based Teachers:
Lessons from a K-12/University Collaborative

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Abstract: The integration of technology throughout the curriculum of both K-12 schools and higher education is widespread throughout America. There are over 1.6 million computers in American schools today (Rosenthal 1999). Millions of dollars are being spent on educational technology (Bull, Nonis, & Becker, 1997), as educators strive to establish a reasonable ratio of computers to students--some (Smith, 1999) suggesting as little as one-to-four, respectively. The preservice teachers enrolled in the Technology-Based Teacher Education program at Lehigh University partner with experienced inservice teachers for a semester to work towards the educational goal of integrating technology into an established curriculum. Preliminary analysis of survey and interview data suggests the partnership may accelerate the professional development of new teachers and provide a support structure for experienced teachers who are beginning the integration process. Both inservice and preservice participants expressed perceived benefits from the project.

The systematic introduction of technology into classrooms has become an increasingly important school reform issue since the 1980's. Recently, the integration of technology into established school curricula of both preservice and inservice teachers has emerged as a focus for colleges of education and K-12 schools. Understanding the role of technology integration within K-12 classrooms is vital to the professional growth of both novice and experienced teachers. Technology resources are requiring educators to rethink how they teach. Educators must focus on integrating technology into the school day: using technology to communicate, to think and to learn (Dwyer, 1996).

Technology as a Tool

Technology--particularly, computer-based applications and software--is emerging as a viable instructional tool for many inservice teachers (Conte, 1998). However, some educators simply have not adopted technology as a tool to use in their curriculum. Lack of comprehensive training is the number one reason why teachers are not using technology in their classrooms (Sykes 1997). Insufficient time and non-existent or inappropriate incentives hinder teacher inservice work (Smith, 1999). If educators are to recognize technology as useful for effective teaching, then staff development should begin with the establishment of underlying philosophies and goals for the use of this technology. Curriculum orientations should guide the goals on how technology should be used. Once a philosophy has been adopted, then the inservice teacher needs relevant and ongoing instructional support (Bull, Nonis, & Becker 1997). On-going staff support and encouragement is key to teachers use of technology in their curriculum (Conte, 1998). Sometimes teachers are unaware of what technologies are available in their schools, or of how to

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take advantage of them when they obtain them. Therefore, when a teacher is willing to give technology a try having onsite support is key. Teachers who come across problems while teaching with a technology, and have support, are more willing to keep trying. Sadly, the opposite is true. Teachers lacking support and encouragement will more likely give up a technology enriched lesson when it goes awry (Conte, 1998). Schools must devise strategies for strengthening capacity within their own ranks in order to sustain their efforts and continue to grow (Maddin, 1997).

Preservice Teacher Education

Our preservice teachers must be skilled and supported in using technology, as well. Presently, thirty-eight states have technology requirements for teacher preparation programs (Rosenthal, 1999). Studies document that preservice teacher technology education has not kept pace with the changes that have affected the quality and quantity of technologies (Anonymous, 1999). Many preservice teachers find that the experience of using a computer is lacking for practical purposes (Laffey & Musser, 1998). Schools of education often overlook the very basic needs of their preservice teachers. According to Rosenthal (1999) only two of the thirty-eight education programs require actual evidence of proficiency in the use of technology in teaching for certification. Through her research Rosenthal (1999) presented several areas in teacher preparation programs that lacked initiative to fulfill these requirements. For instance, many teacher education programs lack the hardware and software necessary to incorporate technology into the teaching agenda.

Some education faculties have not been provided the training they need to use technology effectively. Other higher education faculties have little understanding of the changes technology is bringing to the K-12 classrooms and have not adjusted their own teaching methodologies to reflect these changes. This lack of modeling to preservice teachers provides little support of the use of technology to enhance teaching (Anonymous, 1999). According to a recent study conducted at the University of Michigan several factors deter the growth of preservice teacher education programs. For example, a lack of a written, funded and updated program will ensure little future growth. Finally, many preservice teachers who work in schools for field experiences do not typically work with master teachers who can provide them with support and information on the use of technology.

Technology-Based Teacher Education Program

The Technology-Based Teacher Education (TBTE) Program at Lehigh University is addressing this need of preparing teachers with the belief that modern technologies can and should be used as an educational tool. The TBTE program weaves technology throughout the course work and experiences of the preservice teacher. This ensures that the preservice teacher has a broad and meaningful understanding of how technology, teaching and learning interact. It is the programs belief that technologies--such as computers and the Internet-- are more likely to succeed when their use addresses actual needs, encourages the development of a professional community and is grounded in sound theoretical understandings (Nonis, Bronack & Heaton 1998). One area that TBTE stresses with its preservice teachers is field-based experiences. Preservice teachers enrolled in the Seminar in Elementary and Secondary Education regularly work in classrooms with inservice teachers. In addition to working with an inservice teacher, these preservice teachers are actively observing experienced, model teachers.

Seminar in Elementary and Secondary Education

The Seminar in Elementary and Secondary Education course is designed to be the first course perspective teachers take as they begin the 5-year BA/MEd teacher education program at Lehigh University. The course outline touches on several basic elements of teaching, both from the historical model and the present day perspectives. The discussion-based format allows students to share their ideas, interests and concerns regarding education today as they plan to become our future teachers. In addition to the discussions and weekly readings that are assigned to each student, the last hour of each class is spent in a "Tech Talk." Tech Talks range from learning about email and word processing documents, to databases and digital cameras. Each student is responsible for demonstrating competency in using that specific technology by the end of the course. The objective of the Tech Talk is to introduce to these preservice teachers the varied technologies, both hardware and software, available to them as future educators. This knowledge base also assists them in their field experience work via the Lehigh/Moravian Partnership.

The Lehigh/Moravian Partnership

The students enrolled in the Seminar in Elementary and Secondary Education course at Lehigh form a partnership with Moravian Academy--a K-12 Independent School--to address the needs of both preservice and inservice teachers. The partnership provides a variety of opportunities for both the preservice and inservice teachers. First, the preservice teacher spends quality time observing, interacting and conversing with an experienced educator. The preservice teachers use a Web-based journal form on the course website to share their reflections with the course instructors via field notes for each visit to their classroom. These notes asked the individual students to reflect on the topics discussed, technologies explored, and ideas generated. The field notes allow the preservice teachers to contemplate, reflect, and share concerns about their experience and serve as an on-going update for the instructors on the progress of each preservice-inservice dyad. Second, the preservice teacher work in an environment where technology is available throughout the school. The preservice teacher has an opportunity to see how technology is used in an actual classroom setting. Third, the partnership experience provides an opportunity for inservice and preservice teachers to collaborate on technology integration within an existing curriculum to solve real educational problems. Through conversation, observation and experience the inservice teacher learns more about new technologies and techniques available for teaching.

The Lehigh/Moravian Partnership is overseen by a faculty member at the university and administrators from Moravian Academy and is coordinated by a doctoral student who is a former teacher at Moravian Academy. The coordinator decides on placements for each team and meets with both the preservice and the inservice teachers when necessary. Placement depends on the academic interest and grade level that most interests the preservice teachers. Schedules of both the preservice and inservice teachers are considered, as well. Each semester begins with a gathering of both groups for introductions and orientation to the project. The preservice teachers spend a minimum of 20 hours observing and working with their mentor teachers. The objective for the preservice teachers is to observe and work with an experienced educator. The preservice and inservice teachers decide together upon an area of the established curriculum where technology can be embedded to enhance the learning experiences of the students in the class. The preservice teacher is then responsible for researching and finding appropriate technologies to address the stated needs.

Toward the end of the semester, each preservice teacher is responsible for developing and delivering a final project. The project involves teaching a technology-rich lesson to the students--in partnership with the inservice teacher. The projects vary. Some use the digital camera to incorporate photos into writing samples and slideshows. Others use a specific piece of software--such as Hyperstudio or Powerpoint--to complement a part of the existing curriculum. The inservice teachers provide informal feedback to the students during the presentation. At the end of the semester, each inservice partner provides more formal feedback to their preservice intern through a course evaluation. Finally, the preservice teachers present an overview of their lesson to their peers during their Seminar class. Included in their overview presentation is a written description of the lesson and example of the project.

Formal Evaluation

Data from the first partnership cohort was collected at the end of the Spring 1999 semester from both the preservice and the inservice participants via a 12-item end-of-course survey. Each participant was asked to respond to the Lehigh/Moravian Partnership Feedback Form, a five-point Likert scale questionnaire concerning issues of guidance, structure, professionalism, and benefit of the program. Results in each category are displayed in Table 1, below:

Factor	**Preservice (N=19)**	**Inservice (N=15)**	**F**
	Mean (SD)	**Mean (SD)**	
Guidance	3.91(.86)	3.86(.48)	4.86
Structure	3.92(.90)	3.76(.77)	0.50
Professionalism	4.40(.71)	4.66(.53)	2.39
Perceived benefit	4.36(.60)	4.48(.74)	0.20

$p < .01$

Table 1: Results of End of Course Survey--Preservice and Inservice Participants

An independent t-test was conducted to investigate differences between the inservice and preservice participants with regard to the four factors. No significant differences were found between groups ($p < .01$). It is important to note that, given the small number of participants and the exploratory nature of this initial study, the results of the t-test must be viewed as prefatory.

Further data gathering is in process as the partnership continues to develop. In Fall 1999, a second cohort of inservice/preservice dyads was begun. The inservice and preservice teachers were asked to respond to the

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Technology Teacher Survey once at the beginning of the semester and again at the end. Sample statements for this survey were divided into several categories: technology skill and knowledge, enthusiasm regarding technology, challenges implementing technology and confidence using technology. This survey targets the overall use of technology in the classroom. The data from this survey will add further to our growing understanding of the impact and effectiveness of the Lehigh/Moravian partnership.

Conclusion

The goals of the Seminar in Elementary and Secondary Education course and the Lehigh University/Moravian Academy Partnership includes the development of techniques that help emerging teachers close the gap between the potential of technology and its realization by teachers in their own classrooms. Certainly the experiences of both the preservice and the inservice teachers varied depending on the match made between the two and the expectations that each group had going into the partnership. Generally speaking, however, each pair succeeded with the overall objective: integrating a new piece of technology into an established curriculum. Some had more success than others with the working partnership created within each team. The field notes provide an outlet for the preservice teachers to express concerns. The inservice teachers used meeting time and emails to communicate concerns or problems.

Several modifications arising from what we have learned from the first cohort have already been initiated in the second group. For example, a more formal email system is now available for those inservice teachers involved to communicate with the coordinator on a more regular basis. Other suggestions made from the final evaluation by both the preservice and inservice have led to modifications in what technologies are covered and what initial skills are targeted as primary. By the end of the Spring 2000 semester, over 40 preservice teachers will have had the opportunity to work closely with experienced educators via the partnership. Many of the inservice teachers who took part in the partnership were only marginally facile with technology at the start. Yet, by the end of the course, all the inservice teachers had adopted some form of technology as a tool for both their own teaching and their students' learning. For most, this was a remarkable paradigm shift that will affect their practice to the ends of their careers.

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Pre-Service Teachers As Models

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Abstract

Integrating technology into the curriculum sounds simple. We've talked about it and have been "work-shopped" on it since the early 1980's. But, as educators, what have we accomplished in those years? This paper will share one teacher educator's experiences from germination of ideas to the implementation and success of using student interns (pre-service teachers) as models for the integrative use of technology in the learning/teaching process.

Introduction

Integrating technology into the curriculum sounds simple. We've talked about it and have been "work-shopped" on it since the early 1980's. But, as educators, what have we accomplished in those years? Many educators have taught courses and presented workshops but little has changed. What has been happening in most schools (if anything) is just more of the same - instruction delivered and practiced - now by both teachers and computers. There have been some changes in certain areas of the curriculum, in some parts of the country but not enough to equal the amount of money and time that has been spent by school districts and the state and federal government.

When you walk down the hallways of most schools - both K-12 and higher education - one still sees the teacher as the center of the classroom. Teacher talk is still the strategy that dominates most classrooms today.

Changes are beginning to occur, though slowly (Parker, 1996).

With over thirty years of educational experience – twenty-two years as a middle school educator, I decided about twelve years ago that a different approach was needed if technology integration was to make a difference in the learning environment of our K-12 schools. The approach that it utilized most often in teacher training in use of technology, is learn the technology and then the educator uses it in their learning/teaching environment. Much of the technology "in-service" has been working *with* the tool, not how to *use* it in the learning/teaching process. But, little integration has occurred using this model. Educators need to *see* it being used in the learning/teaching process (Beck & Wynn, 1998). I believe that learning to use technology in the learning/teaching process is more a change in the way we see students learn than in the actual use of the technology itself. It is the shift from teacher directed to student directed learning that may be the actual problem that needs to be solved.

Most of the teachers in today's educational settings received their knowledge and skills in teaching years before the utilization of technology became a reality, and years before much of the research on how

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students learn became known to us. Thus, it stands to reason that not only do educators need to learn about technology but also about new learning theories and models.

I became aware of the need for a different approach when I was asked to speak to a group of pre-service teachers at my undergraduate alma mater. It was then that I realized that a new group of educators, ready to take on the responsibility of being educators, had no more experience using technology in the classroom than the teachers already in schools. Teacher education programs were failing to help the situation (of integration of technology) in any way. They were graduating students with little or no knowledge of the use of technology in the learning/teaching process. Much of what was being taught was the same as when I had graduated from the institution some 20 years ago. Following this realization I studied other teacher education programs around the nation and found that my alma mater was not alone. Most of the teacher education programs were not addressing the issue of technology integration nor the ideas of active learning.

It was then that I began to see a plan for how teacher education could make a difference in the unending pursuit of utilizing technology in the learning process. It was then that I realized "an" answer to this long and enduring problem of the lack of technology integration. Start at the pre-service level and have these students become the "models" of the integration of technology in the learning process.

It took a few years, but I am now involved in doing just that. Pre-service teachers involved in the teacher education program where I now facilitate the learning process are the "technology integration models" for their mentor teachers in their K-12 field-based experiences.

As part of this program, students are taught by the professors to integrate technology into their lesson units and plans. This is modeled by the professor and in turn modeled by the student interns during their field-experience. In this paper I will describe how pre-service students are playing an integral part in technology integration truly happening - with the excitement of learning by student interns, mentors and K-12 students soaring.

The Process

Besides my *enlightenment* that teacher education can play a major role in the area of integrating technology, there are a few other details that help me work with the students in our teacher education program to become the "integration of technology models."

First, my doctoral study in Educational Systems Design made me aware that teacher educators have not been an integral part (if any) of school change and/or restructuring. As part of one of my comprehensive exam questions, I looked at a study done by Dr. Alison Carr (1996) that looked at refereed articles written by "systems thinkers" dealing with school change. In the thirty-five articles that were designated as such, only two mentioned teacher education. Neither of these articles dealt with teacher education in any detail.

This was an affirmation of my beliefs on how we, as teacher educators, may be missing the boat with technology integration, as well and school transformation. In teacher education we have a chance to begin to make a difference in schools - yet we are rarely involved in the change efforts in the K-12 arena.

Second, my assignment as an Associate Professor in residence in a K-6 school has given me the opportunity to "see" first hand how teacher education students can make a difference in the integration of technology into the learning process. I spend four full days a week in a K-6 school that was built three years ago. This school was designed by a group of teachers in the district who are now teaching there. The school is a neighborhood school, not a magnet school, yet it has an emphasis on the use of technology in the learning process. All teachers in the building were hired from within the district with the knowledge that the university would be an integral part of the learning environment, that teacher education classes would be taught in the university classroom (built as part of the new school), and that university professors would be available for training and support of their efforts. I was hired to work with them on a daily basis.

Sounds great. However, in practice not all went as well as we had hoped - at the beginning. First we needed to work through the K-12/higher education rift that is evident in most areas of the country. This takes time and patience. Then it was finding time for me to work with the teachers - before school, during school, after school - *time* - the unending push for more time.

A year ago, our teacher education program became completely field-based. Our students are spending over 50% of their time and work in the K-12 classrooms. I saw a possible answer to the on-going problem of time for training and team teaching. Instead of one person (me) trying to find the time to work with each of the teachers, my students now do this work.

During our class time - I model, we plan, we collaborate, and we prepare lessons that involve the integration of technology into the curriculum. This year has been a wonder - my students, their mentor teachers, and their K-6 students have been involved with many lessons and projects that support the new state curriculum standards AND integrate the use of technology AND everyone involved is thrilled with the results. This year professors at the other PDS sites are using this same process.

Third, the university received a state grant that has helped us restructure our teacher education program. The teacher education program is now completely field-based, all classes being taught at one of the seven PDS sites. Most of the money received from the grant purchased hardware and software (a university classroom lab and additional computers being placed in classrooms where interns are working with mentor teachers), and a professional development library ($10,000 per PDS site) for the seven professional development schools (one high school, one junior high school, and five elementary schools) where we teach our courses – one being the elementary school where I reside.

Before you start thinking - of course this would work with all of this support - I believe that this project can be replicated with the resources that most teacher education programs and school districts now possess. A change in the collaboration efforts between the university and the school district need to be solidified (little money needed for that), classrooms in school district buildings where teacher education classes can be taught need to be made available, and the technology resources of the K-12 schools need to be utilized as part of the teacher education program. Much of what will be mentioned in the remainder of this article can be done with one computer in a classroom that has Internet capability and is hooked to a large monitor or projector for full class or group viewing.

Model/Learner Project

This project emphasizes the use of technology in the K-12 field-based teacher education courses. As mentioned earlier, teacher education students at all seven professional development schools must integrate technology into the lessons taught as part of their internship. Thus, they are modeling, for their mentor teachers appropriate ways to integrate the use of technology into the curriculum. Reciprocal teaching (Palincsar, & Brown, 1984) occurs when the mentor teacher models for the interns various teaching strategies, classroom management strategies, lesson planning, and other essential components in the everyday learning environment. Both interns and mentor teachers team plan and team teach lessons using technology as an integral part of the lesson.

The integration of technology in the learning/teaching process takes on an apprenticeship model (Collins, Brown, & Newman, 1989) of learning. The apprenticeship moves back and forth from intern to mentor teacher as lessons are planned and taught, by the mentor teacher, in a team teaching environment, and intern-facilitated lessons. "In the apprenticeship model the learner sees the processes of work. In the traditional apprenticeship, the expert shows the apprentice how to do a task, watches as the apprentice practices portions of the task, and then turns over more and more responsibility until the apprentice is proficient enough to accomplish the task independently." (Collins, A., Brown, J. S., & Holum, A., 1991). During their apprenticeships, both the mentor teacher and the intern learn new ways of facilitating learning, using active learning processes as well as integrating the use of technology as a tool in the learning/teaching process.

Some examples of the intern modeling for the mentor teacher include:

1. Interns (pre-service teachers) use one computer in a classroom - utilizing a large screen monitor for full class instruction.
2. Interns use the Internet as a motivating factor at the being of a unit or lesson.
3. Interns use the Internet as an integral part of a lesson - student interns develop webquests and web pages as part of a course in the teacher education program.
4. Both interns and mentor teachers participate in collaborative on-line projects such as AfricaQuest, GalapagosQuest, AsiaQuest (Classroom Connect), Earth Day Project, Hundred Day Project, Jamestown, M&M Project, Problem of the Day, and many more.
5. Interns use of SmartBoards for full class instruction. Many of the mentor teachers have the availability of this hardware but have not used it until the interns demonstrated its use in a lesson they taught.
6. Both interns and mentor teachers use on-line field trips to enhance a unit or lesson or in preparation for a real-time field trip.
7. Use of *PowerPoint* by interns, mentor teachers, and students to present information, including use of Internet sites.

Conclusion

These projects serve as an on-going professional development for both interns and mentor teachers in the integration of technology into the learning/teaching process. The projects are always changing as new ideas, new sites, new technologies (digital cameras with video capability) are added to the teacher education program.

In the past two years I have witnessed what can happen to the learning process of interns, mentor teachers and K-12 students as technology plays a more important role in their instructional lives.

I challenge each and everyone of us, as educators, whether we be K-12 educators, teacher educators, or administrators, to model for learners the integration of technology into the active learning process. As Collins, Brown, and Holum state it:

> Apprenticeship is the way we learn most naturally. It characterized learning before there were schools, from learning one's language to how to run an empire. We have very successful models of how apprenticeship methods, in all their dimensions, can be applied to teaching … they help point the way toward the redesign of schooling… as well as improve the ability to learn throughout life.

The use of the apprenticeship's four basic aspects of modeling, scaffolding, fading, and coaching can, and I believe will, lead us to a dimension of learning that we all strive.

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A Collaborative Technology Partnership

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Abstract: Partnerships between universities and local K-12 school districts provide learning opportunities for university professors, K-12 students and teachers, and pre-service teachers enrolled in undergraduate programs. This paper describes a partnership between a southwestern university and a local K-12 school district. The partnership was designed to enhance computer competence and confidence in 250 middle school students, build an on-going relationship between the university and the local school district, provide opportunities for pre-service teachers to observe best practices in technology integration in K-12 educational settings, and allow a university professor to conduct a qualitative research project.

Introduction

Partnerships between universities and local K-12 school districts provide learning opportunities for university professors, K-12 students and teachers, and pre-service teachers enrolled in undergraduate programs. This paper describes a partnership between a southwestern university and a local K-12 school district. This partnership was designed to:

- enhance computer competence and confidence in 250 middle school students;
- build an on-going relationship between the university and the local school district;
- provide opportunities for pre-service teachers to observe best practices in technology integration in K-12 educational settings; and
- allow a university professor to conduct a qualitative research project.

A K-12 teacher and administrator initiated a partnership with the state university in which a K-12 teacher and a university professor collaborated to team-teach classes to middle school students. These students were bussed to the university campus where they spent approximately ten hours in a technology-rich environment. The students completed web-based research projects and then created multimedia projects summarizing their research. Undergraduate university students observed the team-taught classroom and gained insights into best practices of technology use in K-12 education. The university researcher conducted a qualitative study on the middle school students' understandings of technology. Data sources included an open-ended survey, observations, document review, and focus groups. This paper describes the process of establishing this partnership, the participants, the workshop model, and benefits to each stakeholder group.

The Process of Establishing a Collaborative Technology Partnership

A partnership between a southwestern university and a local K-12 school district seemed advantageous for all stakeholders: middle school students could benefit from use of computer facilities at the local university, K-12 administrators could satisfy parents' desire for greater access to technology for their children, undergraduate students studying to be teachers could observe K-12 technology integration on their own campus, and a university researcher could conduct an extensive study on middle school students using technology. Since this

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partnership was beneficial for all involved, establishing the alliance was straightforward. Each stakeholder outlined goals and objectives to other stakeholders, and during several collaborative meetings, they developed a workable plan for this collaborative technology partnership. Details about stakeholders and the semester-long development process for this project are outlined below.

Time Frame	*Stakeholders*	*Task*
Start of semester	K-12 Teacher District Administrator	Initial inquiries about the feasibility of the project.
Three weeks later	K-12 Teacher District Administrator University Teacher/Researcher	Introductory meeting to establish goals, discuss dates and facilities, and do preliminary design.
Next three weeks	K-12 Teacher University Teacher/Researcher	Planning sessions to establish curriculum, choose participants, and investigate bus and room availability.
Mid semester	K-12 Teacher University Teacher/Researcher	Submitted research proposal to appropriate groups at K-12 district and university. Finalized bus and room availability.
Two weeks later	K-12 Teacher K-12 and University Administrators University Teacher/Researcher	Research proposal approved.
Next two weeks	K-12 Teacher University Teacher/Researcher	Pilot project with 30 students. Adjustments made based on pilot project.
End of semester	K-12 Teacher K-12 and University Administrators University Teacher/Researcher	Evening meeting for participants' parents and teachers to introduce and explain the project.
Throughout the following semesters	K-12 Teacher University Teacher/Researcher	Groups of 25-35 students participated in the project at the university computer classroom. Researcher conducted qualitative study. Undergraduates observed team-taught setting.

Participants and the Workshop Model

The primary participants in this project were a teacher from the participating K-12 district, a university professor serving as teacher-researcher, approximately 250 middle school students from a local K-12 school district, and undergraduates enrolled in the education certification program at the university. Middle school students were enrolled in classes for gifted and talented students in twelve elementary schools throughout the district. These students visited the university four times for two-and-a-half hours each visit. Students were predominantly Caucasian; approximately 20% were Hispanic, 3% were Asian, 1% were Native American, and 1% were African American. They had a mean age of 12.5 years. Socioeconomic status varied widely among the middle school students.

This project was grounded on the following assumptions:

- learning is an active process facilitated by the creation of an environment that encourages risk-taking and creative and critical thinking;
- teachers strive to create such environments to facilitate learning and provide opportunities for self-reflection and evaluation;
- learners learn by doing;
- learning is social and is fostered by collaboration; and
- technology is a tool for facilitating learning rather than the focus of learning.

Benefits to Participants

The project was designed to benefit many stakeholders. Documented benefits to each stakeholder group are described below.

During their four visits to the university computer classroom, the *middle school students* spent approximately ten hours in a technology-rich environment. Through completing a WebQuest on cloning and creating a *PowerPoint* presentation to share their research findings, they enhanced their skills in:

- using the Internet as a research tool;
- using the Internet as a tool for enhancing multimedia presentations;
- working collaboratively and reaching consensus;
- designing multimedia presentations using *PowerPoint*;
- delivering multimedia presentations to share their research with peers and parents.

The middle school students also became familiar with a college campus and became aware of higher education opportunities at the local state university.

University and K-12 administrators established both a workable model for K-12 – university partnerships and an on-going partnership. This partnership resulted in:

- increased goodwill between the two institutions;
- increased enrollment of K-12 teachers in graduate classes in educational technology courses at the university;
- increased access for K-12 students to computers and pedagogically-sound practices that integrate technology into the established K-12 curriculum;
- happier K-12 parents because of increased student access to technology;
- on-going dialog about ways to continue and expand this partnership.

University undergraduates studying to be K-12 teachers observed their university professor and a middle school teacher using technology in theoretically grounded and pedagogically sound ways. Student observations were meaningful as they involved good teaching practices in which technology was a tool rather than the curricular focus. Through a series of observations followed by class discussions, they were able to:

- provide a pedagogically sound argument for using technology in elementary or secondary classrooms;
- describe their view of the learner and the learning process;
- describe the categories of software best suited to their view of the learner and the learning process;
- describe best practices for using technology in elementary or secondary classrooms;
- describe the supports and obstacles to these best practices.

Finally, a *university professor* was able to conduct an in-depth and on-going qualitative study of middle school students' understandings of technology. By using open-ended surveys, observations, document reviews, and focus groups, the professor examined the changing relationships between gender and understandings and uses of technology. The results of this research are forthcoming.

Conclusion

Partnerships between universities and local K-12 school districts are advantageous to all stakeholders. This collaborative technology partnership:

- provided a workable model for K-12 – university partnerships;
- established an on-going relationship between the university and a local school district;
- opened the way for future partnerships with other K-12 school districts;
- enhanced the computer competence and confidence in 250 middle school students;
- provided opportunities for pre-service teachers to observe best practices in technology integration in K-12 educational settings; and
- allowed a university professor to conduct an in-depth qualitative research project.

As indicated above, all stakeholders benefited. In addition, a viable model for K-12 – university partnerships was developed and fine-tuned. This model can be used in the future with other interested K-12 districts in the area. As more partnerships are formed, all partners should seek funding to support several aspects of the project including student bussing, substitute teachers for K-12 teacher participants, and graduate research assistants. The university should continue to contribute the computer classroom and the time and efforts of the university teacher-researcher. Finally, future partnerships should strive to attract corporate sponsors so that K-12 educators, university educators and corporations are working together to optimize educational opportunities for learners at all levels.

The WebPage supporting this project is located at <http://www.west.asu.edu/achristie/peoria/IDEAL.html>.

Changing Preservice Teacher Education: A New Paradigm Integrating Technology

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Abstract: This paper will describe a project that was designed to create teachers for the 21st century by raising the minimum technology requirements in their course of study. This project required future teachers to apply their technology skills in the classroom at K-12 partner schools by creating an electronic portfolio with a set of technology-based classroom activities. This project directly served approximately 76 preservice teachers, 80 classroom teachers in 16 school districts, and a significant number of university faculty. The preservice teachers involved in this project volunteered to take an additional six credits in advanced technology that included topics related to instructional design systems and virtual learning communities. The preservice teachers were trained to use the most sophisticated technology tools for research, information analysis, and problem solving in all content areas including special education. This paper will present the why, how and the where changes occurred during the initial phase of this project.

Introduction

Currently every teacher education student is required to complete one three-credit technology course. This course is designed to ensure that every pre-service teacher receives a baseline of experiences using computer hardware and software for professional productivity, research, and classroom presentations. Students learn to use computer technology for desktop publishing, database management, spreadsheet analysis, and simple multimedia applications. They learn to evaluate software in a variety of curriculum areas, use e-mail, and use the Internet for communications and research.

The Project

This systematic initiative has four closely related educational objectives. First, the project ensured that all preservice teacher participants develop the knowledge and skills to integrate technology into their teaching and learning processes. Second, the project ensured that the K-12 cooperating teachers enhance their knowledge and skills in integrating technology into their own curricula. Third, the project provided opportunities for the university faculty to increase their knowledge and skills in the use of technology in their own teaching. Fourth, the project established a state-of-the-art technology resource center for use by preservice teachers, inservice teachers from surrounding school districts, and university faculty.

The first objective of the project was met by having three members of the School of Education designed two, three-credit courses that provided the educational opportunities for the preservice teachers to master the advanced technology competencies stated at the end of this paper. At the completion of these two technology courses the preservice teachers are required to demonstrate or provide documentation that they have mastered the 48 advanced technology competencies reflecting national educational standards. The content of these courses focused on the use of technology to improve student learning in the K-12 classrooms and reflect specific activities related to grade levels and content areas. The courses were team taught by three members of the School of Education who have specific expertise in the major content areas.

The second objective required recruiting schools and cooperating teachers for the project. During the summer of 1999, a week long workshop was conducted for the participating inservice and preservice teachers. The workshop included hands-on technology based activities and training to help their student teachers apply the advanced competencies in actual classroom settings.

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The third objective was met by having university faculty from specific content areas participate in workshops for the inservice and preservice teachers. The university faculty provided examples of how they have integrated technology into their instructional practices.

The fourth objective required the development of a technology center with advanced technologies that included over 30 multimedia stations with Internet access, scanners, digital cameras, CD recorders, and a variety of special education assistive devices. The center is equipped with wide-bandwidth communication lines designed for desktop videoconferencing. The technology center provides opportunities and resources for students, faculty, and inservice teachers to develop projects that promote the integration of technology into their curriculum. The project incorporated an extensive web-based component(http://planetx.bloomu.edu~center) that contains activities, resources, a newsletter, and examples of projects created in this program.

The key to the success of this project is the inservice teachers who acted as mentors for the student teachers participating in this project. In the initial phase of the project, the preservice teachers met with their respective mentors to design technology-based units and supporting lessons that match the existing curriculum being taught by the inservice teachers. During the second phase, the preservice teachers researched, designed, and tested their activites in the technology center. In the last phase of the project, the preservice teachers incorporated their technology-based activities into their student teaching experiences.

The two, three-credit advanced technology courses are currently an elective option for the university's teacher education program, however, it is the intent of the project that these courses will become a requirement for all entering freshmen in the School of Education.

Advanced Technology Competencies

For each of the following statements, code in **True for your Yes** response and **False for your No** response on the accompanying answer sheet. For each True response you must be able to document or demonstrate your knowledge and skills associated with that particular statement

1. Can you identify and use computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the teacher?
   Yes______ No______
2. Can you compare and contrast current instructional design principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum?
   Yes______ No______
3. Can you design, deliver, and assess student learning activities that integrate technology across disciplines for a variety of student grouping strategies and for diverse student populations?
   Yes______ No______
4. Can you identify and report on the responsible, ethical, and legal use of technology, information, and software resources?
   Yes______ No______
5. Can you identify and report on the basic principles of effective instructional design associated with the development of multimedia learning materials?
   Yes______ No______
6. Can you create and produce simple hypermedia/multimedia products that apply basic effective instructional design principles?
   Yes______ No______
7. Can you select and use appropriate tools for communicating concepts, conduction research, and solving problems in subject areas and grade levels?
   Yes______ No______
8. Can you organize and implement collaborative technology-based projects and team activities?
   Yes______ No______
9. Can you collect and evaluate examples of emerging programming, authoring, and problem solving environments?
   Yes______ No______
10. Can you create and initiate online workgroups to build a collection of knowledge on specific topics?
    Yes______ No______
11. Can you design and publish simple online documents presenting information that include links to critical resources?

Yes______ No______

12. Can you design, develop, and produce instructional units that involve compiling, organizing, analyzing, and synthesizing of information and that uses technology to support these processes?
Yes______ No______
13. Can you conduct, evaluate, and report the research associated with online resources of information that support and enhance the k-12 curriculum?
Yes______ No______
14. Can you identify and describe strategies to support the development of school and laboratory policies, procedures, and practices related to the use of technology in those environments?
Yes______ No______
15. Can you research, evaluate, and produce recommendations for purchasing instructional software and hardware to support and enhance the k-12 curriculum?
Yes______ No______
16. Can you design and write recommendations for the organization, management, and security of hardware and software in different learning situations?
Yes______ No______
17. Can you identify strategies and product documents for troubleshooting and maintaining various hardware and software configurations in a variety of instructional settings?
Yes______ No______
18. Can you select and configure a complete computer system and install the operating system and a minimum of one application package?
Yes______ No______
19. Can you identify and use information access and telecommunication tools to support research and instruction throughout the k-12 curriculum?
Yes______ No______
20. Can you use and demonstrate distance learning delivery systems including computer, audio, and video conferencing?
Yes______ No______
21. Can you create and present a multimedia presentation using advanced features of a presentation tool and computer projection system?
Yes______ No______
22. Can you install, configure, and demonstrate the use of mass storage devices?
Yes______ No______
23. Can you identify and describe software currently used in classrooms and administrative settings?
Yes______ No______
24. Can you investigate and recommend in writing, purchasing strategies and procedures for acquiring administrative and instructional hardware and software?
Yes______ No______
25. Can you identify and classify adaptive assistive hardware and software for students and teachers with special needs?
Yes______ No______
26. Can you evaluate and report on the technology concepts and skills being taught in a k-12 setting?
Yes______ No______
27. Are you familiar with methods and strategies for teaching technology concepts and skills in a laboratory and classroom setting?
Yes______ No______
28. Can you identify and upgrade technology supported curriculum to reflect on-going changes in this area?
Yes______ No______
29. Can you design, produce, and demonstrate integrated technology-based activities that involve teaming and/or small group collaboration?
Yes______ No______
30. Can you identify and present activities and resources to support regular professional growth related to the use of technology in the classroom?
Yes______ No______
31. Can you describe student guidance resources, career awareness resources, and student supported activities related to technology?

Yes______ No______

32. Can you compare and contrast national k-12 technology standards with benchmarks set by state and local agencies?
Yes______ No______
33. Can you identify and critique professional organizations and groups that support the field of educational technology?
Yes______ No______
34. Can you design and produce a set of assessment strategies and methods that will evaluate the effectiveness of instructional units that integrate technology?
Yes______ No______
35. Can you summarize and apply principles and practices of educational research to educational technology?
Yes______ No______
36. Can you summarize and report major findings and trends related to the use of technology in education that support the integration of technology in the k-12 environment?
Yes______ No______
37. Can you apply theories of learning, teaching, and instructional design and their relationship to the use of technology to enhance learning?
Yes______ No______
38. Can you describe social and historical foundations of education and how they relate to the use of technology in schools?
Yes______ No______
39. Can you design and produce a research project that includes an evaluation component of a specific technology in the k-12 classroom?
Yes______ No______
40. Can you demonstrate the use of more than one authoring environment?
Yes______ No______
41. Can you describe and analyze accepted principles of strategic planning to facilitate curriculum designed for teaching with technology?
Yes______ No______
42. Can you identify and evaluate national, state, and local guidelines for developing curriculum plans for technology integration?
Yes______ No______
43. Can you demonstrate methods for teaching hypermedia development in a problem solving format?
Yes______ No______
44. Can you demonstrate methods for teaching at least one authoring program?
Yes______ No______
45. Can you demonstrate methods for teaching the use of media-based tools – television, audio, print media, graphics?
Yes______ No______
46. Can you observe and compare strategies used in educational technology in a variety of authentic educational settings?
Yes______ No______
47. Can you develop and teach a series of lessons that apply technology to support learning?
Yes______ No______
48. Can you document and assess a significant field-based activity involving experiences in instructional program development, staff development, resource management, and managing change related to technology use in schools?
Yes______ No______

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Using Technology in Field Experience in Regular and Special Education

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Abstract: Preliminary results of a study designed to measure the effectiveness of two Funding for Results grants at Southeast Missouri State University are shared. These grants allowed the purchase of computer equipment and software that was used by Block III regular education and additional computer equipment, assistive technology and software that was used by Block IIIA special education students. Each of these groups used these supplies on their field placements. The study, using a pretest-posttest repeated measures design, was intended to measure the awareness level of both the preservice students using the equipment and the cooperating teachers working with the students. Results outlined in this paper summarize preliminary results as case studies of four students who described the impact of the technology on their field placements.

Introduction

Schools today are preparing the employees of the future. Projections for the year 2000 indicate that five of the ten fastest growing job areas will be computer related (College Planning Network 1996). Today's school students must be trained to function in a rapidly changing world, a world in which the amount of information at least doubles every 5.5 years (Naisbitt 1994). To be well-prepared, students must be trained to use technology and to access, search, and evaluate information. Schools have recognized this need and have increased their investment in technology for the last several years, with a recent ratio of students to computers at 5.7 to 1 (Market Data Retrieval 1999).

At the same time technology is increasing in the schools, the population of experienced teachers is declining. An estimated 2 million new teachers will be hired in the next decade (National Council for Accreditation of Teacher Education 1997). Schools of education have a valuable opportunity to fill these openings with teachers who are trained to use technology successfully. Indeed, teacher education institutions are recognizing this need. Seventy-six percent of education professors surveyed by the Office of Technology Assessment (1995) agreed that technology plays an important role today and eighty-two percent felt it would continue to play an important role. Yet, in a recent survey of graduates of teacher education institutions, more than fifty percent of the graduates felt that they had been poorly prepared in the use of information technology in the classroom. (Barksdale 1994). In a review of literature on information in technology and teacher education, Willis and Mehlinger (1996) concluded that while many students received coursework in information technology, little training in technology was tied to or required in field experience.

The National Council for the Accreditation of Teacher Education (NCATE) recognizes that teachers must be trained to use technology. To meet this need, NCATE collaborated with the International Society for Technology in Education (ISTE) to spell out minimum technology skills for all beginning teachers. The Council for Exceptional Children is currently working with members of their Technology and Media (TAM) Division to outline minimum assistive technology skills for

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NCATE's list of competencies for beginning special education teachers (Lahm & Nickels 1999). NCATE recommends that schools of education infuse these technology skills into their regular operations.

ISTE has researched how teacher education institutions can successfully accomplish training preservice teachers to use technology. In a survey of teacher education institutions, the International Society for Technology in Education (1999) verified the Willis and Mehlinger (1996) results. Their survey found that most teacher education institutions do not routinely use technology during field experience. Their survey determined, however, that the use of technology during experiences is more highly correlated with successful technology integration than separate technology course requirements.

The need for preservice teachers to use technology in their field experience situations was the basis for this study. In 1997 and 1998, a $25,000 multi-year Funding for Results grant, "Enhanced Technology Experiences for Block III Elementary Education Students," provided educational software, laptop computers, and projection hardware for preservice teachers to take into the field during their Block III (third year) field experience placement. In 1999, another $25,000 Funding for Results grant, "Integration of Assistive Technology into Teacher Preparation", provided software, laptops, projection equipment, and assistive technology for preservice teachers in special education to take into the field for their Block IIIA (third year) special education field experience. This study is designed to measure the technology knowledge of both preservice teachers and their cooperating teachers in the field placements where the technology is being used. It further assesses the attitudes of both the preservice teachers and the cooperating teachers toward the technology being used in the field experience.

The Study

The state of Missouri has developed Funding for Results grants for the purpose of enhancing university classroom instruction. Portions of these grant monies are provided to each public university in the state. At Southeast Missouri State University, a committee decides which grants will be awarded each year with preference, in recent years, given to grants designed to improve experiential learning. The two grants involved in this study, "Enhanced Technology Experiences for Block III Elementary Education Students" and "Integration of Assistive Technology into Teacher Preparation" were designed to allow students to integrate technology into field experiences even when the field experience placement did not have a computer in the classroom.

The Funding for Results grants allowed the purchase of equipment that Block III regular education field experience students and Block IIIA special education students were able to take to their classrooms. This equipment included laptop computers, projection devices, and software for both grants. In addition, the Block IIIA grant allowed the purchase of software and hardware designed for students with disabilities. A survey instrument was designed for both field experience placements to be administered to both preservice teachers and cooperating teachers at the beginning of the semester and at the end of the semester. This survey instrument was designed to measure the awareness of instructional technology, software and hardware, and attitudes toward technology use in the classroom. Researchers designed the survey instrument to help answer several questions of both regular and special educators:

1. Will the use of this technology during the field experience improve the awareness of

technology that is available for instruction?

2. Will use of the technology improve its infusion into classroom instruction?
3. What is the teacher's opinion toward infusing technology into the curriculum?
4. Will the knowledge of the operations of computers and peripherals improve?
1. Are the teachers disseminating their new knowledge?

Additional questions were asked of the special education students:

6. Are the teachers more aware of methods for using technology in assessment?
7. Are the teachers more aware of technology that is available for students with disabilities?
8. Do the teachers feel better prepared to make recommendations for technology for students with disabilities?

The study used a repeated measures design, with a survey instrument administered at the beginning of the semester and a posttest survey at the end of the semester. Researchers predicted that each of these questions would show a positive increase as a result of using the materials and equipment purchased with the FFR grants. To measure the change, survey instruments were administered to both pre-service teachers and inservice teachers. The survey instruments were the same except that the special education students and teachers had questions about assistive technology that the regular education students did not have. The survey instruments were adapted from the instrument used by Blackhurst (1988).

The Results

While the posttest survey results are not yet available at the time of this paper, a structured interview was administered to four students, two from Block III and two from Block IIIA. These interviews provide a formative report on the anticipated results of this study. This paper is a description of their experience in using the FFR grant equipment as reported in four case studies.

Regular Education

Regular education students at Southeast Missouri State University proceed through a structured block program that involves numerous field experiences. At each level, preservice teacher participation and responsibilities in the classroom increase, so that by the time they student teach, pre-service teachers have spent over 250 hours in a classroom. Students involved in this study were part of the Block III level. Block III is the final level of instruction and field experience placement before pre-service teachers begin student teaching.

The Funding for Results grant, "Enhanced Technology Experiences for Block III Elementary Education Students" provided four laptop computers and two projection devices for students to use in the field. In addition, the grant purchased several software packages to take to their field placements. These software packages were in the area of mathematics, science, and social studies, as well as tool packages such as *Microsoft Office*, *The Cruncher*, and *The Graph Club*.

Regular Education Case Study 1: Annie

Annie was a junior at Southeast Missouri State University. She was placed in the professional development section of Block III, spending about 250 hours in the classroom during the semester. Annie was placed in a regular 4th grade classroom in a small city setting. Her students came from a generally lower socioeconomic level, with several minorities represented.

Annie used the computer technology in 4 lessons. During these lessons, Annie used web pages she had previously downloaded as the basis for a Missouri history scavenger hunt. A video projector was used for large group searches and students worked in pairs for small group work. She had previously shown the students how to conduct web searches, so they were fairly comfortable with the process.

Annie reported that she was already a competent computer user, having worked for the university computer development center helping faculty and students. She strongly felt that technology benefits students, saying, "My students were legitimately interested in learning when the material was presented in a multimedia format. It may not have provided new information, but it provided the excitement associated with learning."

Annie reported that she used a laptop, LCD projector, scanner, layout software and the Internet while teaching the students. She reported that use of the equipment helped her to better integrate technology into instruction by facilitating the development of student storybooks, integrating use of the Internet by using an Internet scavenger hunt, and incorporating an instructionally appropriate software package such as *Hyperstudio*. She further reported that she has shared her new knowledge at technology conferences and with teachers in the field who asked general questions about the technology. She learned to identify software for its clarity of instruction, its player control, and its fidelity in situations that were designed for the classroom. To maximize the integration of technology into the schools, she suggested the use of prolonged exposure for students and lots of teacher training involving meaningful skills.

The impact of the technology on the classroom teacher where Annie worked was evident in the post-instruction assessments conducted by Annie and her cooperating teacher. Students who had not previous shown much interest in social studies lessons were excited and motivated to complete their searches. According to the cooperating teacher, the fact quiz given several days after the searches also showed a greater degree of correct knowledge than usually was shown by previous classes. This teacher also commented that she planned to use similar techniques in her classes in the future.

Regular Education Case Study 2: Shannon

Shannon was a junior at Southeast Missouri State University. She was placed in the professional development section of Block III, spending about 250 hours in the classroom during the semester. Shannon was placed in a regular 4th grade classroom in a rural setting with very few minorities.

Shannon used the computer technology on 2 occasions. She had not felt that technology benefited her students much until she used *PowerPoint* with the students. She saw how much more students were motivated by the technology when it was used beyond the normal drill and practice mode. "The kids were so excited when the computer was used to present their lesson materials in a new way. They also got to use a CD-ROM to further research the topic they were currently studying. This was much more meaningful than sitting at the computer to do daily math and reading work."

The impact of the technology on the classroom where Shannon worked was evident in the excitement generated during the discussion of the social studies topics covered by her *PowerPoint* presentation. The students also completed a fact book based on the presentation, working in small groups. The cooperating teacher commented that the students seemed to remember the facts more quickly than was usual in her class. She also noted that she would like her school to obtain a video projector for the elementary teachers to share since it made using the computer with the whole class much more effective.

Shannon reported that she used a laptop, LCD projector, CD-ROMs, overhead projector, and a TV-VCR while teaching the students. She noted that the equipment provided with the grants helped her to know more technology available for integration into instruction, but that she still did not know everything that was available. She reported that she improved her knowledge of the computer operations necessary to set up a presentation, but that setting up the equipment still was somewhat confusing to her. She had shared her lesson with other preservice teachers in her Block III class and received favorable responses. Shannon shared that she had learned to value software for its ability to stimulate students' minds. To maximize integration by teachers in the schools, she suggested not overusing technology, but using it meaningfully starting in the early grades like kindergarten or first grade and making equipment available for all classrooms.

Special Education

Special education students at Southeast Missouri State University proceed through a structured block program similar to the one in regular education with field experience at every level. In addition to classes with the regular education students, the special education students have a semester block with special education methods courses, Block IIIA. The field experience placements during this semester occur in a special education classroom.

The Funding for Results grant, "Integration of Assistive Technology into Teacher Preparation", allowed the purchase of five laptop computers and one projection devices for students to use in the field. Several items for students with disabilities were purchased: Intellikeys, Don Johnston Key Largo, adapted toys, software made for students with learning disabilities, an augmentative speech device, switches and switch adapters. In addition, the grant purchased several instructional software packages not specifically made for students with disabilities to take to their field placements. This software was in the areas of reading, writing, mathematics, science and behavior.

Special Education Case Study 1: Stephanie

Stephanie was placed during her special education Block IIIA semester in a K-6 learning disabilities classroom in a small city, middle class school. She used the computer technology each time it was available and all four occasions when her college supervisor made a formal observation. She had already used technology in the classroom, but this semester, she reported that she saw its expanded value in the area of writing for students with disabilities. She saw how students with learning disabilities who have a large oral vocabulary and lots of creativity could transfer what they want to say to paper without being hindered by poor handwriting.

Stephanie was convinced during this experience that the students benefited from technology and actually had opportunities to see observe its benefits. She was working with a second grader who spelled "center" as "senter" during a writing lesson. Using a word prediction program provided by the grant, the second grader was trying to type the word. This word prediction software, *Co-Writer*, generates a list of ten words starting with the letter that was typed. The students can run the cursor over these words to have the software read the words. When the second grader could not find "center", she asked if the word began with a "c", discovering her own mistake. When told so, she finished the writing selection.

Stephanie stated that she was aware that computer technology could also be used for assessment. She said that she knew that a spreadsheet could be used to report behavior charting and that a multimedia authoring programs like *Hyperstudio* could be used for portfolios. Her chance to use these packages during this activity was limited though by her teacher who did not permit her to participate in reevaluations and Individual Educational Planning (IEP) meetings. However, she felt more able to make IEP recommendations for students with mild disabilities who benefited from software that bypassed reading and writing deficits.

Stephanie's technology skills were competent before this semester, but she gained the knowledge of setting up the projection device and became the computer technician for others in the class. She still felt a bit uncomfortable with the Macintosh operating system and chose to use the PC system for all her activities. Stephanie reported that she used the IBM laptop and projector, along with word processing software, word prediction software, spreadsheets, graphs, and IEP software and math software. She reported that the equipment provided with the grants helped her to know more technology available to be integrated into instruction for students with disabilities.

Stephanie was able to use the special education technology and software in several lessons. One of her lessons required that students write a paragraph about themselves. Only one of the four students wrote more than the minimum amount of sentences. When given the chance to use the computer, they each added more to their stories. They were motivated by the computers and felt that it was so easier to write using the computer.

Stephanie's final lesson with the computer used word prediction software again, but this time added *Inspiration* to generate character or story maps. Students created a story map with *Inspiration* and turned their map into an outline. This outline was then incorporated into a story that included digital pictures. They had fun using the hardware and software, stating that they did not know that writing a draft could be so much fun. Their results were well-written stories that Stephanie found were longer than their hand-written stories.

As a result of participating in the grant, Stephanie developed standards that she felt defined good educational software. She reported that good software needed to be self-explanatory, modifiable for different learning needs, educational and fun. Stephanie's recommendations for a district developing a plan for integrating technology included planning for a variety in software and hardware and having technology available for all students and teachers.

Stephanie was very involved in dissemination of what she learned through using the materials of the grant. She was asked to present her students' computer products to the administrators and to teachers in the elementary building where her field experience placement was located. Her teacher requested that her special education director purchase the equipment and software after seeing the results that Stephanie obtained with the students. In addition, she was invited to co-present with the grant author to an audience of special education teachers, administrators, and Missouri Department of Elementary and Secondary Education employees where she demonstrated the technology and explained how she used the software and hardware with her students.

Special Education Case Study 2: Laura

Laura was placed into a K-6 grade mixed disabilities classroom in a small city school district but in a building with primarily lower socioeconomic students and several minorities. She used computer technology in several lessons during her field placement. She reported that she felt much more knowledgeable about technology for students with disabilities than before this semester, although she felt that she still needed information for disability areas such as visually impaired, hearing impaired and physically disabled. She felt that computer technology that has been created for students with disabilities could benefit not only these students, but also those without disabilities. She noted that it could increase their academic performance and allow the students to meet their maximum potential. At the same time, she felt that some technology could be inappropriate for students with disabilities. "However, throughout this semester, I have seen students with ADHD and BD sit at a computer for the whole class period and not be disruptive, work diligently, and complete a productive piece of work. I feel that these students would not have finished the assignment if they weren't allowed to use technology in producing their assignments."

Laura felt that she could make recommendations about technology for students with disabilities because she had the opportunity to use the software and hardware and incorporate it into lessons. She also became aware of how software could be used to score an assessment and create a portfolio, although she had not had a chance to try them in a full classroom.

Laura had an opportunity to disseminate information about the computer technology, sharing information with peers and with teachers in the public schools, including schools outside of her field placement. She shared a variety of the software with her cooperating teacher and was asked by other teachers in the building to share it with them also. In addition, they asked her how they could apply the technologies in their classrooms. Her student teacher supervisor for next semester asked to see the equipment over winter break after watching Laura present it to local special education teachers, special education administrators, and Department of Elementary and Secondary Education staff members.

Laura feels competent now to infuse this technology into instruction. She used a talking word processor with a student in mathematics who benefited from hearing the math problem spoken. She also combined several packages into a lesson on Huck Finn. First her students used the Classic Adventures CD-ROM to read the book and took the quizzes that were included in the CD-ROM. Next, they used *Inspiration* to create a semantic map of events in the chapter. Finally, they would use *Write Outloud* with their semantic maps and outlines from *Inspiration* to write a report over the chapter. They asked her if they could print out the quizzes from Huck Finn to help them.

Laura reported that she was able to improve her operation of a computer and learned to connect peripherals like a projector and Intellikeys keyboard to the computer. She also used a talking word processor, *Write OutLoud*, IEP software, scanners, printers, a LCD projector, and a digital camera during this experience. She learned to identify good software by its student friendliness and its educational value. She also valued appropriateness, effectiveness, and cost efficiency. She looked for software that was motivating, provided feedback, and adjusted its rate of difficulty. To plan technology's effective use in schools, she learned to research new software packages to make sure it met student needs, taught what the teacher wanted, adjusted ability levels and was not biased. She recommended that assistive technology be interchangeable to increase its usefulness and that teachers be inserviced and encouraged to use the hardware and software.

Preliminary Conclusions

This study was undertaken to investigate the results of using technology with regular and special education students in an elementary school setting. Preliminary results indicate several findings:

2. Preservice and cooperating teachers were not comfortable integrating software and hardware into classroom lessons but improved their awareness, opinion of, and ability to infuse technology into instruction.
3. Preservice and inservice teachers disseminated the knowledge that they gained about technology.

Additional conclusions for special education indicate:

4. Preservice teachers were aware of some technology applications for assessment, but improved their knowledge through grant activities.
5. Preservice teachers were somewhat aware of technology that is available for students with disabilities, but improved this knowledge with grant activities.
6. Teachers, both preservice and inservice teacher, improved their ability to make recommendations for assistive technology for students with disabilities.

Discussion

NCATE (1997) has recognized the need for technology literate teachers to fill the need for a world that is demanding technology-trained workers. This study investigated the use of technology by both special and regular education students provided by two Funding for Results grants. Preliminary results of the study were reported through four case studies of preservice teachers, two in special education and two in regular education.

Results of these case studies indicated that all four preservice teachers improved their awareness, opinion, and ability to integrate technology into teaching. These results agree with the ISTE study (1999) that indicated a positive correlation between infusing technology into current courses in teacher education and successful integration. This awareness extended to an improvement in knowledge of assistive technology for students with disabilities for special education majors. This ability helps in making recommendations for assistive technology for the Individual Education Programs of students with disabilities.

Preliminary results indicate that both the preservice students and cooperating teachers shared their knowledge with other teachers. This ability to disseminate technology expertise was identified by Blackhurst (1988) as a recommended technology skill for teachers. This study seems to indicate that infusion of technology into field experience provides a method of making teachers aware of both of new technology and successful methods of infusing it into their teaching, providing them with the motivation to share this information.

This study investigated effects of one semester's use of technology provided by two FFR grants. Further research to determine the long term effects of these grants would be to follow up the students as teachers to determine if they continue to infuse technology into their own classrooms. Additional follow-up research on the cooperating teachers' classrooms is also recommended, to see if they continue to apply the methods observed and used during this semester.

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Getting Program and Faculty Up to Speed for NCATE 2000 Standards
Project EXCITE

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Abstract: This paper provides a model for revising curriculum and training faculty to integrate technology into instruction while meeting new NCATE standards for teacher education units. Identified as key partners in this project are the undergraduate teacher education faculty and students, student mentors, technology staff, faculty and students in K-12 partner schools. The three-year plan, designed during the Summer 1999 with implementation beginning Fall 1999 is a work in progress. Key components include needs assessments, establishing a knowledge base, program redesign, professional development, fearless faculty, faculty accountability, tech support, teacher education students, and project evaluation.

In the 1990s school districts in the United States have invested billions of local, state, and federal dollars to equip schools with computers and advanced telecommunications equipment. During this same time period higher education institutions have scrambled to advance their own technology infrastructures. In many instances, technological advancement in higher education has proceeded unevenly, with Colleges of Education hard pressed to match the resource bases of such Colleges or Schools as Medicine, Engineering, or Business. This is an unfortunate situation given the critical need for "Teachers...to understand the deep impact technology is having on society as a whole...[especially when we wish them to develop] an attitude that is fearless in the use of technology" (NCATE, 1998, pp. 5-6).

In 1996 a joint AACTE/NCATE data collection project (Persichitte, Tharp, & Caffarella, 1997) assessed the level of technology use by schools, colleges, and departments of education (SCDEs). Too few students are expected to use computers, televisions and VCRs to share information in their campus classroom settings. Students do not use SCDE Web sites to obtain assignments and syllabi, implying that SCDE faculty are not making best

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use of the available information infrastructure...it appears that the majority of faculty have not reached a comfort level beyond basic user skills with...information technologies. Willis and Mehlinger (1996) have succinctly summarized the literature on technology and teacher education when they say "Most pre-service teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology" (p. 978). This conclusion, coupled with the fact that the number of schools in the United States having access to the Internet has increased from 35% in 1994 to 89% in 1998 (NCES, 1999a), while classroom teachers in the United States are "least likely to report being very well prepared for activities...integrating educational technology into the grade or subject taught" (NCES, 1999b, p. 74), leaves the inescapable conclusion that Colleges of Education must in turn assume greater responsibility for the development of technology skills among their own faculty members and America's future educators. As Rosenthal (1999) points out, "Bringing the existing teaching force up to speed [technologically] is a massive task...[but it is] a problem that will be greatly exacerbated *if the teachers entering the profession have not been adequately prepared to use information technologies* [italics added]" (p. 22).

The general image of technology and teacher education described above characterizes, to some degree, the current situation in Wichita State University's College of Education. Until about a year ago, the College was essentially "on its own" to provide the technology and staff development necessary to bring faculty and staff into the personal computer age and to provide appropriate learning experiences for students. During the 1998-1999 academic year the College Technology Committee completed a technology mission, vision, and commitments document that incorporates recent International Society for Technology in Education Standards (ISTE, 1999) and current and draft standards of the National Council for Accreditation of Teacher Education (NCATE, 1998). During this time, the College's Technology Committee also completed a needs survey of all faculty and staff in the College of Education.

Though we face many of the obstacles to preparing technologically proficient teachers including lack of equipment, faculty training, technical support, and funds (among others), we have mapped out a 3-year plan to increase curriculum integration in our undergraduate teacher education program which has already culminated in three grants submitted and funded. These grants will provide (a) portable projection units and laptops, (b) a SMART Board, and (C) faculty development support through Expanding our Curriculum Integration through Technology Education (EXCITE).

The purpose of this paper is to share a model for revising curriculum and training faculty to integrate technology into instruction while meeting new NCATE standards for teacher education units. Identified as key partners in this project are the undergraduate teacher education faculty and students, student mentors, technology staff, faculty and students in K-12 partner schools (2 private and 8 public schools). The three-year plan was designed during the Summer 1999 with implementation beginning Fall 1999. The following design and process is a work in progress. Some steps in the process have been completed, others are in progress, and still others are yet to come.

EXCITE Project Design

Technology Plan

The College of Education was the first college unit on campus to develop a technology plan based on mission and goals statements. Both faculty and student goals were identified and developed within this plan. Action plans were also developed to provide a support structure for student access and integration of technology into instruction. The mission and goal statements of this plan can be found at http://education.twsu.edu/technology/plan.htm

Needs Assessment

A survey of classrooms used by the teacher education program was conducted in the fall of 1999 to determine hardware and software needs. At that time COE faculty members were scheduled to teach 63 courses in three different buildings. The survey revealed that only one classroom in the three buildings was connected to the campus network and another was being remodeled to include a network connection. Only one program had access to a portable projector. A portable electronic lectern was planned for one of the buildings. The College maintains one computer lab for student use with 20 Macintosh G3s, three Gateways, and a G3 server. A larger computer lab is available for all university students in a building not used by the College of Education. The university library has a small computer lab open for student access to the Internet. Neither of these labs can be used for instruction. As a result of this survey, the College of Education Technology committee submitted and received a grant to purchase 5 portable projectors. Our goal is to have as many classrooms equipped with appropriate equipment as possible and where equipment is not available, to have at a minimum video players, laptops, and portable projector units available.

COE faculty have participated in two separate needs assessment. The first needs assessment, completed in Spring 1999, determined the level of familiarity with technology, the frequency of use, the perception of potential of the technologies, and the amount of training received and needed. Table 1 shows the most frequently used tasks for which faculty use computers. (See more results on-line at http://education.twsu.edu/technology/needs.htm)

A second assessment, the Profiler Online Collaboration Tool, developed by Technology Assistance for Kansas Educators (http;//www.taken.org). This assessment is designed to determine the level of technology integration achieved by each faculty member. The Profiler was also administered to the student mentors along with a basic skills assessment. Partner school faculty also completed the Profiler.

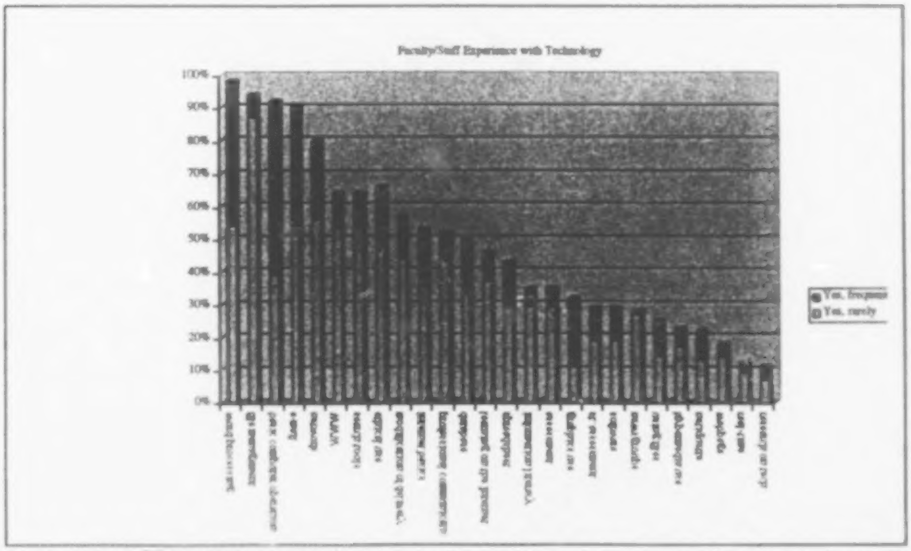

Table 1: Faculty reported use of computer technology in Spring 1999.

Knowledge Base —

During Fall 1999 a subcommittee of the EXCITE Grant Advisory Committee met to examine technology standards of

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several professional organizations including the International Society for Technology Education (ISTE), National Council for the Accreditation of Teacher Education (NCATE), and Kansas State Board of Education (KSBE), as well as student outcomes for the local school district, Unified School District (USD) 259. The committee recommended to the Undergraduate Teacher Education Programs Committee the endorsement of the ISTE standards as the basis for our program goals, major topics, and outcomes. Following their endorsement in October, 1999, the standards were presented to the entire teacher education faculty in December for their endorsement.

Program Redesign: Integrating Technology

Teams of faculty work together in each Block (semester) of the undergraduate teacher education program, coordinating instruction, curriculum, and field experiences beginning in the Preprofessional Block (second semester of the sophomore year), and concluding with Block IV (second semester of the senior year.). All sections of any one course in the program are taught from a common syllabus outline, the complete syllabus filed in the departmental office each semester. Following a review of those syllabi in Fall 1999, Project EXCITE facilitators will meet with each set of Block faculty to determine what types of activities they required of their students and the variety of instructional approaches used. During this meeting Project EXCITE facilitators will suggest ways that technology might support faculty instruction and student learning. The ideal progression would be that faculty would try the suggested strategies and if they felt they were appropriate, the additions would be made to the common syllabus outline which would be approved first by Block faculty, by department faculty, by the Undergraduate Teacher Education Committee, and finally by all teacher education faculty. At that point, the technology outcomes would be integrated into the undergraduate teacher education curriculum in a meaningful way, not as an added-on and isolated course.

Professional Development

Concurrently with program redesign specific to technology, and beginning in Spring 2000 faculty teaching required courses in Block II and all methods instructors (Block III) will participate in professional development designed to build skills in integration of technology into the curriculum, including use of the Internet and multimedia presentations. Key faculty from partnership K-12 schools and university student mentors will also attend the professional development activities. Fall 2000 will see these outcomes extended to all elementary, fine arts, music, physical education, English, math, science, social studies, and foreign language methods courses. Finally, in Fall 2001, outcomes for student teaching will require the use of technology in instruction.

As a partner in the EXCITE grant, Apple computer agreed to provide training workshops and server space for sharing Units of Practice developed by faculty and classroom practitioners. Student mentors and faculty were shown how to access Apple's Units of Practice and other educational resources. The format provided by Apples' units will be used to create a model for additional lesson plans.

To provide students and faculty authentic learning experiences with a variety of technologies EXCITE set out to involve faculty in instructional projects with partnership schools and to build awareness of how technology is used in the schools. Our goal is to develop online models and videotapes of how partner schools use technology with their students that may be used in methods courses. Video conferencing and discussion forums to enhance communication between teacher education students and partner school students is encouraged.

Three public school Professional Development Schools (a high school, middle school, and 3 elementary schools) a middle school, two elementary schools, and 2 parochial elementary schools become partners of the COE in developing technology-rich environments. A list of "experts" will be developed using the Profiler to assist faculty and mentors in integrating technology into instruction. One elementary school is a computer magnet school. The teaching staff from that school are able to provide model lessons for methods classes. On-line chats will be developed between teacher education students and classrooms to explore how technology is used in the schools. Teachers from partner schools receiving professional development take the information back to their schools to (a) model the use with their students, (b) teach to their students, (c) train other faculty, and (d) provide support to university students assigned to them. Student mentors are assigned to each of the teams of block faculty as they work to integrate these new technologies into the existing program.

Fearless Faculty

The COE Technology Committee and Professional Development Committee worked with Project EXCITE personnel to plan and promote inservice for faculty based on identified faculty needs with the intent that we could develop technologically fearless and competent teacher education faculty who are capable of modeling and integrating technology into their instruction. A partnership with Apple Computer provided a series of workshops on integrating technology and developing multimedia for teacher education faculty and community school partners. In order to involve teacher education faculty from content areas such as music, math and art as well as classroom practitioners in the training, a meeting was planned that engaged all partners in the teacher education program in a discussion of how technology is being used, how it should be used, and how the partners could work to combine resources to meet our goals. Inservice was planned and implemented to include school practitioners as well as university faculty. The COE Professional Development Committee conducted their own survey of faculty needs and used the results to establish a series of workshops for faculty interested in online instruction and projection devices such as the SMART Board. To monitor faculty involvement, needs, and attitude, an electronic faculty log was initiated in Fall 1999.

During the fall semester, 1999, a multimedia cart was introduced to faculty who were in turn encouraged to use the various components of the cart in instruction. Faculty had support from tech staff in preparation and set up--but were encouraged to "go it alone" during instruction. Weekly logs from faculty included comments such as

> --" I do want to say that I was so encouraged to be able to make the mobile cart work perfectly the first time--in front of a class of 50! Whew. Everything went without a hitch on the PowerPoint presentation."

> --" I tried an FER #2 presentation in CI 430 that had a PowerPoint presentation, video clips, CD-Rom resource evaluation and then showed students what the format of their paper would look like in an APA Format. Before I started, I got hives when I realized that I didn't have a back up plan for the lesson in case the cart crashed. When it was over I got a migraine--relief of tension. But I DID IT!!!! And it was great! I'm ready to do it again!"

Other informal on-line comments indicate that after some initial scouts (those sent to find the various types of technology that could be used), a few explorers (those sent out to see if it is really true) emerged:

> "[One member of the tech staff indicated] she would like us to encourage totally electronic portfolios. Let's mention this to our advisees as an option. Who knows what wonderous things we may get!
>
> (Thinking about the all-electronic portfolios...I feel like we're hanging on to a rock...tetering at top of Niagara Falls...and we're all about to get inundated with a [another] new gush of water (technology) forcing us over and down into the abyss below! I hope you all have on your lifejackets*!)

Faculty Accountability

Just how will faculty be accountable for the integration of technology throughout the pre-service program? Within the undergraduate teacher education program several program safeguards are already in place. Syllabi are filed each semester in departmental offices and are then checked against the program document for consistency with the program document. Technology integration can easily be seen by the course purpose, major topics, learning outcomes, and schedule of instruction and assignments. In addition, as part of Project EXCITE, faculty were asked to fill out an electronic log weekly that asked them to (a) describe any activity that modeled the use of technology for instruction, required students to use technology within the class time, or required students to use technology outside of class time to complete assignments, indicating any activity that is something new you have tried for the first time; (b) describe any activity that you would have liked to use but did not have the training, the software or the hardware necessary; (c) list any professional activities related to technology they participated in and how they thought they would use the training in their own teaching; (d) acknowledge any help they received from tech support staff, student mentors, faculty, secretaries, etc. and if so, from whom they receive help and for what purpose; and (e) tell us anything else they would like to share related to technology in their instruction?

Tech Support

The COE supports a full-time Coordinator of Educational Computing who provides instructional support for faculty and students interested in integrating technology into their instruction, and a full-time Technical Staff person who provides full-time technical support for faculty and students. The Tech Staff person supervises three part-time student assistants based in the computer lab who serve as teaching assistants and technical support for students and faculty.

Teacher Education students were invited in Fall 1999 to submit applications to the EXCITE Mentor Program which will pair them with faculty based on faculty requests for assistance. Students applied for the mentor positions on-line and faculty submitted their requests for assistance on-line as well. Six students were selected and trained to provide assistance and training for faculty. The EXCITE grant provided $12 an hour for student mentors to work with faculty which created an additional 60 hours a week of assistance and support for faculty who want to integrate technology into their instruction. Student mentors receive training and experience they can use with faculty and in their own fields of study. This mentor program is intended to provide ongoing support for faculty beyond inservice and workshops offered by the college and the university.

Students

The primary focus of all grant activities is the enhancement of the undergraduate teacher education program. We hope to develop technologically proficient students. Students see teachers model appropriate use of technology in the courses, complete assignments in coursework using technology, and teach lessons to peers on campus and to students in schools. Competencies for knowledge and skills will be within meaningful components of instruction. Necessary changes in methods courses and evaluation instruments will follow.

Evaluation

As part of the current assessment process in teacher education, students use a professional portfolio to interpret their philosophy and pedagogy and provide evidence they are approximating and eventually accomplishing the goals of teacher education (Potthoff, Carroll, Anderson, Attivo, & Kear, 1996). The professional portfolio begins in Block I and is assessed each semester. Self-selected entries, teaching evaluations, and the list of relevant courses all provide potential resources of information about the use of technology in learning and instruction. In our previous research in the area of integration we found that "only our most intense and obvious efforts at modeling integration are successfully encouraging preservice teachers to submit integrated portfolio entries." (p. 57) It is our hope that modeling effective use of technology in instruction will have a significant impact on student use, which will be documented in their portfolios.

Other assessment activities include documentation as well as quantitative and qualitative evaluation components. Evaluation planning, implementation, and oversight are coordinated by the College of Education's Coordinator of Educational Assessment and Associate Dean for Administration and Graduate Program Support.

Conclusion

The model presented in this paper for revising teacher education curriculum and training faculty to integrate technology into instruction while meeting new NCATE standards for teacher education units may not be appropriate for every college of education. However, it may offer insight into problems and suggestions for solutions that fit with other teacher education programs. Developing fearless faculty is a lofty goal, but once faculty become leaders, their students will be empowered to be leaders and advocates for change in schools.

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The Viewing and Doing Technology Project: Preparing Tomorrow's Teachers

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Abstract: Southwest Texas State University's (SWT) Center for Professional Development and Technology (CPDT) is a university-school partnership that involves 20 school sites and more than 300 preservice teachers. With funding support from the US Department of Education, the SWT CPDT is developing a model for preparing future teachers to use technology by helping university faculty integrate it into courses preservice teachers take. The model, titled the Viewing and Doing Technology Project, recognizes the knowledge and talents of faculty members who use technology and establishes themed workshops during which faculty share their expertise and help other faculty members to expand their knowledge.

Introduction

Southwest Texas State University's Center for Professional Development and Technology (CPDT) is an award-winning program that has been in existence since 1992. The university-school partnership is a vigorous one that continues to grow. Of the 20 school sites where university interns and teacher educators are assigned, five are secondary level. This project will focus one site, Hays High School, in order to establish a model by which all 20 sites can provide the optimal learning experience for preservice teachers.

Despite the strength of the field-based program, the infusion of technology is inadequate or lacking in the delivery of instruction by teacher educators, university instructors in departments outside of the School of Education, mentor classroom teachers at the sites, and cooperating teachers in the student teaching setting that follows the 9-hour field-based experience. Reasons for the deficiency are lack of development opportunities, poor equipment, and inadequate communication among stakeholders.

In order to best prepare future teachers to use technology, all stakeholders in the teacher preparation arena (university faculty, cooperating teachers, in particular) must model the use technology in effective and appropriate lessons. This became the primary goal of the Viewing and Doing Technology Project (VDT)—a one-year systematic effort that is funded by a $115,000 grant award from the US Department of Education. SWT and Hays Consolidated Independent School District, one of the members of the CPDT Consortium, matched the grant award, bringing the total funding for the VDT Project to $230,000.

The VDT Project was designed to ensure that interns observe competent to exemplary uses of technology in the delivery of instruction at both the university and the school level. The goal of the project is to enlist the cooperation of all stakeholders in a collective effort to provide a technology-rich learning environment for preservice teachers. Five objectives support the goal is attained: (a) support SWT education professors as they infuse technology; (b) use videocase methodology in classes and professional workshops; (c) collaborate with disciplinary departments to restructure courses; (d) provide professional development opportunities for cooperating teachers in high schools where preservice teachers will engage in student teaching; and (e) seek and acquire recognition and financial support from the Hays County community.

The outcome of a year of professional development activities will be the establishment of a model for the preparation of new teachers and the means for disseminating, expanding, and sustaining the model. The model will provide preservice teachers multiple opportunities to view appropriate and meaningful uses of technology in

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instruction as well as to provide authentic opportunities for practicing new skills and strategies. This paper will describe each of the goals and anticipated outcomes of the VDT Project and provide a mid-year evaluation of the success of this effort.

Goal 1: Support SWT Education Professors as They Infuse Technology

Seven workshops were scheduled in the 1999-2000 academic year for the ten faculty members who teach in the field. Because the faculty are off campus Monday-Thursday, they have few opportunities to share knowledge and expertise. The seven workshops were designed to carve out a dedicated time for sharing. They were scheduled on a Friday in each of the following months: October, November, December, January, February, April, and May.

The ten faculty members who make up the VDT Team were invited to conduct one or more of the workshops and were interviewed to determine the expertise of the member and to select a topic for the assigned workshop. Six members agreed to conduct one or more workshops. Topics include putting courses online, creating web forms/surveys and using database programs to analyze input, doing a WebQuest project, writing/editing/revising papers collaboratively using a word processing program, creating interactive multimedia products, and using videocase methodology to teach preservice teachers.

The anticipated outcome of the workshops are the following: (a) all courses will be available online, (b) web sites will include forms or surveys for students to complete, (c) preservice teachers will be required to use multiple features of a word processing program to edit and revise writing, (d) WebQuest projects are included in the list of projects for each VDT Team member's course, (e) all VDT Team members use multimedia and require their students to do so, (f) all VDT Team members use videocase tools to teach classes. Outcomes are to be measured by examining each VDT Team member's syllabus for the Spring 2000 semester and for the Fall 2000 semester. The syllabi should show evidence of incorporation of the skills/strategies learned through the workshops.

In addition to the workshops, members of the VDT Team will receive "just-in-time" technical support from two graduate assistants who will be on call Monday-Friday from 8:30 a.m. to 3:30 p.m. These assistants will travel to the various school sites, if needed, to help solve technical problems and to teach the faculty member how to use particular software programs.

Goal 2: Use Videocase Methodology in Classes and Professional Workshops

A software program tentatively titled Classroom Windows (CW) is being developed specifically for the VDT Project. CW is a version of another software application, Literacy Education: Application and Practice (LEAP) (Stephens 1995), which has been re-purposed to fit the needs of the VDT Project.

LEAP is a videocase-based interactive software program designed and developed to use in university courses and professional development workshops that deal with methods for teaching reading and writing. LEAP was constructed according to the precepts of cognitive flexibility theory (Spiro & Jehng 1990). Users of LEAP are guided through short videocases, or minicases, of classroom teachers in naturalistic settings. Minicases can be explored from multiple perspectives through built in navigation routes in the software program. As in LEAP, CW will provide minicases of teachers and their students using technology in high school classroom settings. CW will provide guided exploration of the minicases as well as links to the World Wide Web and a threaded discussion group. The minicases will show teachers at Hays High School using technology with sophomore, junior and senior level students. Three teachers have been videotaped; their tapes will be edited and prepared for insertion into the CW software structure.

CW is still in production. The final version will be available on CD-ROM in late Spring 2000 and will be distributed to the ten VDT Team members for use in their classes. The anticipated outcome is that the team members will use this tool in Fall 2000 semester courses.

Goal 3: Collaborate wSith Disciplinary Departments To Restructure Courses

The rationale for expanding the professional development beyond the College of Education is that all of the secondary teaching methods courses are taught outside of the College of Education. It is critical, then, to insure that preservice teachers are exposed to effective application of technology in their disciplines and that they are required to practice using it within those classes.

A one-week summer workshop is scheduled in mid-May 2000 for 10 faculty members in the various colleges at the university. Five technology proficient faculty members within these colleges have agreed to conduct workshops that resemble the workshops conducted in the College of Education. One member will conduct a full-day workshop on each of the five days. The topic will be determined by the member's expertise and interest. Each of the five has been requested to bring one member of their staff whom they think would benefit from the experience.

The anticipated outcome of the summer workshop is that the information/skills shared each day are incorporated into the Fall 2000 semester syllabus of each attending member.

Goal 4: Provide Professional Development Opportunities for Cooperating Teachers In High Schools Where Preservice Teachers Will Engage in Student Teaching

Preservice teachers who are enrolled in the classes taught by the faculty members who attend the academic year workshops and the summer workshops will be placed in a student teaching setting in the Spring 2001 semester. If the cooperating teacher with whom they will work is not proficient with technology or not interested in integrating it, then it is likely that both student teacher and cooperating teacher may find the experience unproductive. To help prepare the student teaching environment for a technology-proficient teacher in training, eight cooperating teachers will be invited to enroll in a summer course at the university; tuition and fees will be paid by the VDT Project.

The anticipated outcome of this goal is that the eight cooperating teachers will support their student teachers in the Fall 2000 and Spring 2001 semesters as they both explore ways to integrate technology in the middle school or high school classroom.

Goal 5: Seek and Acquire Recognition and Financial Support from the Hays County Community

To assure a positive impact of the VDT model and to justify the energy, effort, and funding spent on the model, a continuity plan is vital. A team of faculty members is exploring the further development of the VDT Project. Plans for disseminating information, acquiring more funding, and enrolling more faculty members in professional development activities are being made. A promotional videotape will be distributed to possible funding sources as well as interested institutions in the community. Papers will be presented at conferences such as this one. Proposals for funding will be written in the Spring 2000 semester. Outcomes from the previous four goals will be reported in all of the materials that are written/developed for the continuity plan.

The anticipated outcome of this goal is that the VDT model is revised and refined and that funding and support is made available for expansion. Five of the field-based blocks—all at the secondary level—are involved with the VDT Project this academic year. It is hoped that the remaining 15 field-based blocks—all at the elementary level—will benefit from the next level of the VDT Project.

Conclusion

The VDT Team and all supporting individuals have dedicated much time and energy to the attainment of the five goals of the VDT Project. To date, evaluations of activities indicate that the model has been effective in helping faculty members become more comfortable with technology. By June 2000, indicators will determine what components of the model need to be revised/restructured. By December 2000, the full impact of this model on how well new teachers are prepared to use technology will become evident. In informal interviews the VDT Team and others who support it have indicated that they are confident that the model will have a positive impact on both faculty and students.

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Using the Internet to Promote Technology Integration, Higher-order Thinking Skills and Motivation

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The purpose of this paper is to share the findings of a study that examines issues regarding K-12 integration of Internet instruction. The main thrust of this project involves the development of a comprehensive educational internet database dedicated to assisting preservice teachers entering the K-12 classroom to incorporate Internet resources via the creation of WebQuests based on the model developed by Bernie Dodge (1999).

Introduction

The Cognitive Domain

Educators continually strive to find ways to create learning situations that exercise higher level thinking skills. Bloom, Englehart, Furst, Hill & Krathwohl's (1956) taxonomy of educational objectives for the cognitive domain classified goals of an educational system into six objectives: knowledge, comprehension, application, analysis, synthesis and evaluation.

According to Bloom, et al. 1956), the first three levels of the taxonomy set up the foundation for higher-order thinking skills. Knowledge includes "those behaviors and test situations which emphasize the remembering, either by recognition or recall, of ideas, material, or phenomena" (Bloom, et al., 1956, p. 62). This objective also applies to transfer of learning in that the learner has to relate to and make judgments in terms of answering questions or problems at the time of testing that are posed in a different form than that of the original learning situation. Comprehension involves "the grasp of meaning and intent of the material" and application concerns "remembering and bringing to bear upon given materials the appropriate generalizations or principles" (Bloom, et al., 1956, p. 144).

Generally, higher-order thinking skills reside in a learner's ability to analyze, synthesize and evaluate concepts and information. Analysis involves breaking down material into its constituent parts to determine relationships between the parts. Analysis can be considered a prelude to evaluation and is

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considered an important objective in the fields of science, social studies, and the arts, among others. As an objective, Bloom, et al. (1956) divides analysis into three levels: identifying or classifying elements of a communication, determining the explicit relationships among the elements, and recognizing organizational principles and structure of the communication as a whole.

The next educational objective that is considered to be indicative of higher-order thinking skills is that of synthesis which Bloom, et al. (1956) defines as "putting together of elements and parts so as to form a whole" (p. 162). Synthesis is a process of combining the elements in such as way as to create a pattern or structure not seen before. This category of the cognitive domain is thought to constitute creative behavior. According to Bloom, et al. (1956), the main difference between synthesis and the categories of knowledge, comprehension and application is that the first three objectives deal with "working with a given set of materials or elements which constitutes a whole in itself" whereas synthesis involves drawing upon "elements from many sources and put[ting] these together into a structure or pattern not clearly there before" (p. 162). Synthesis can be classified in terms of three sub-categories evidenced by their products: a unique communication, a plan or set of operations, and a set of abstract relations.

Finally, the last educational objective that is indicative of higher-order thinking is that of evaluation which is defined as "the making of judgments about the value, for some purpose, of ideas, works, solutions, methods, material, etc." (Bloom, et al., 1956, p. 185). Generally, evaluation involves a combination of all of the other educational objectives. It is also crucially linked to the affective domain and can, therefore, be regarded as indicative of motivation. Further, evaluation may be the last step in the domain, but it may lead to acquisition of new knowledge, re-evaluation of prior knowledge comprehension, or further analysis and synthesis. The evaluation component is composed of two components: judgments in terms of internal evidence and judgments in terms of external criteria. A major goal of our educational system is to expand a learner's existing and potential knowledge base by operationalizing and integrating knowledge, comprehension, and application with analysis, synthesis and evaluation to engender higher level thinking skills.

The Affective Domain

According to Gagne & Driscoll (1999), the most fundamental element to learner motivation is the "desire to enter into the learning situation." The cognitive domain is intertwined with the affective domain. According to Krathwohl, Bloom & Masia (1964), the most sought after kinds of affective domain objectives are interest and motivation. It is the motives, drives and emotions of the affective domain that are the predominant factors in the achievement of cognitive behavior. Achievement motivation results from positive affect and takes "the form of building upon self-discovery as a means of fostering interest in learning material" (Krathwohl, et al., 1956, p. 58). Krathwohl, et. al's (1964) taxonomy of educational objectives for the affective domain. fits well with a widely-known model of motivation - Keller's (1979) ARCS model. The four basic elements of the ARCS model are: Attention, Relevance, Confidence and Satisfaction. Learner attention may be captured by colorful graphics, animation or music. Relevance might be garnered by relating the topic to be studied to the learner's personal goals or lifestyle. Learner confidence may supported by providing an opportunity to demonstrate what they have learned to peers. Learner satisfaction can be enhanced by providing meaningful opportunieis to use the newly acquired knowledge or skill gained as a result of the learning experience. The purpose of the ARCS model is to make theory and research findings in the field of motivation applicable to classroom instructional settings.

As further support for considering both the affective and cognitive domains, research on learning and motivation has found that motivation increases an individual's energy and activity level (Maehr, 1984, Pintrich et. al 1993; and Vernon 1969) and promotes time on task in terms of initiation of certain activities and persistence in those activities. While motivation directs an individual toward certain goals, it is also dichotomous in that when people exert effort toward some goals, they often must direct it away from others (Csikszentmihalyi & Nakamura, 1989). Additionally, motivation affects learning strategies and cognitive processes employed by an individual. Generally, a task is, in and of itself insufficient for successful learning. Cognitive processes such as attention, meaningful learning, elaboration, and self-monitoring comprehension must occur as people engage in a particular learning activity. Further, learners must think about what they are seeing, hearing and doing (Carroll, 1989; Tobin, 1986, Wittrock, 1983). Therefore, cognitive engagement is one of the benefits of a high level of motivation. Finally, intrinsic motivation is considered to be more central to producing meaningful learning than is extrinsic motivation.

Where Technology Comes In

The Internet and World Wide Web have great promise as they present new vehicles to enable educators to achieve their goals of promoting higher-order thinking skills while also enhancing learner motivation to promote the kind of cognitive processing necessary to produce meaningful learning.

In particular, an effectively designed WebQuest is an excellent vehicle to promote both higher-order thinking skills and motivation. A WebQuest furthers the technology integration initiative supported by educators across the country by offering an inquiry-oriented activity in which most or all of the information used by learners is obtained via the World Wide Web. Developed in 1995, by Bernie Dodge and Tom March, WebQuests are designed to maximize time on task by focusing learners' attention on using the information provided on the World Wide Web rather than searching for it. Effectively designed WebQuests encourage higher-order thinking skills such as analysis, synthesis and evaluation and are useful for integrating technology into the classroom while providing a safe way for students to research the Internet.

Part of developing a WebQuest involves researching appropriate World Wide Web links to be incorporated into a WebQuest. Anyone who has ever engaged in Internet searching has experienced the tremendous amount of time required to find meaningful and relevant sites while wading through a great deal of "garbage" to get to the good stuff.

In a recent paper, Herbert Simon and Richard King Mellon effectively summarize the dilemma faced by the technological revolution. They assert that it is not information that is the scarce factor today, it is a human being's ability to attend to the information and the time required to attend to it. "While the means of acquiring information have been expanding, there has been no expansion in the number of waking hours in the day available for attending to that information. Time and attention are scarce, and becoming scarcer every day. In particular, we have no time to process the new information that is being disgorged on us" (Simon & Mellon, 1996). According to Roblyer (1997), a predominant problem cited by teachers regarding Internet infusion is the amount of time required to adequately research and effectively integrate its use into K-12 classrooms.

Through the use of templates and other time-savings devices, WebQuests have the potential to give educators a concrete, quick-to-learn method of integrating technology into the curricula without requiring them to spend a prohibitive amount of time on the procedural aspects of learning new software. Further, it seems that it is just as important to motivate teachers to want to use technology in the classroom as it is to motivate students to want to learn.

WebQuests provide benefits to students in that they facilitate organization and management of on-line resources so that students are engaged in meaningful learning activities, thus reducing student time spent searching the Internet for sources and thus, promotes time on task. The Internet is a dynamic medium, full of information that is accompanied by visual and aural stimuli. If appropriately and effectively utilized via a WebQuest, these dynamic elements can help focus and maintain learner attention, promote student interest, and engender intrinsic motivation.

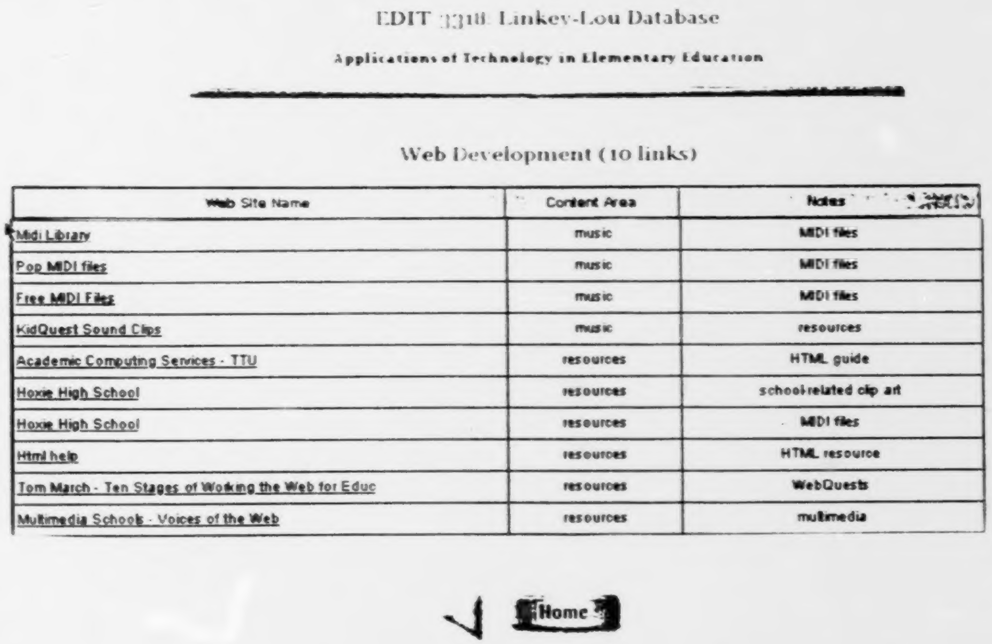
Methodology

The research undertaken is a multi-part project. The first part consists of "Linkey-Lou", a comprehensive educational Internet database developed using Microsoft FrontPage 98 and Microsoft Access. This web site is currently being developed to aid higher education faculty and pre-service educators in developing WebQuests to encourage technology integration while promoting higher-order thinking skills and motivation in elementary and secondary school students. The site, which is currently in development, consists of 4 main resource areas:

- Internet Ethics;
- Policies, & Security;
- Web Development;
- Professional Educational Organizations; and
- Software & Publishers, and Subject Web Resources.
-

Fig. 1 below represents an example of a resource page currently being developed.

Figure 1. Example from "Linkey-Lou" database.



EDIT 3318 Linkey-Lou Database

Applications of Technology in Elementary Education

Web Development (10 links)

Web Site Name	Content Area	Notes
Midi Library	music	MIDI files
Pop MIDI files	music	MIDI files
Free MIDI Files	music	MIDI files
KidQuest Sound Clips	music	resources
Academic Computing Services - TTU	resources	HTML guide
Hoxie High School	resources	school-related clip art
Hoxie High School	resources	MIDI files
Html help	resources	HTML resource
Tom March - Ten Stages of Working the Web for Educ	resources	WebQuests
Multimedia Schools - Voices of the Web	resources	multimedia

A search mechanism is planned to enable educators to search the database by topic or keyword.

Another portion of the project involves the development of an evaluation rubric that will aid WebQuest developers to properly evaluate and select effective Web sites by assessing features such as aesthetics, cognitive effectiveness, cognitive task level technical sophistication, and resource quality and quantity. The evaluation rubric utilizes the foundations presented in the ISTE standards concerning planning and delivering instructional units for technology integration by incorporating guidelines for content comprehensiveness and clarity, screen design, motivational components based on Keller's ARCS model (Keller, 1979), interactivity, and higher order thinking skills.

Data will be collected and analyzed as a result of a focus group study to evaluate the comprehensiveness and effectiveness of the WebQuest resource guide. A focus group collects data by way

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of a semi-structured group session which is moderated by a group leader and held in an informal setting. The purpose of a focus group is to understand all the perspectives of the participants. A focus group was chosen because it saves times by allowing a researcher to interview several people at one time, it allows one to collect rich data at a reasonable cost, it can explore topics and generate hypotheses for quantitative research, and group interaction tends to bring out data that would not otherwise be obtainable through observation or via questionnaires or surveys. The sample selected for the focus group will consist of purposive sampling, which concentrates on those subjects that will provide the most meaningful information. In the case of this study, focus group participants consist of preservice K-12 teachers who are enrolled in EDIT 3318, Applications of Technology in Elementary Education, at Texas Tech University. Data collection is in progress to assess whether our resource model aided effectively in the development of student WebQuests.

Additionally, quantitative data collection will entail collecting information from university-level methods educators concerning the site's present and potential usefulness to their students. This information will be used to determine other possible needs that the Internet database resource might serve to further the College's aim of preparing pre-service educators in the State of Texas. The instruments being developed will utilize a Likert-type scale with comment choices ranging from None to High and a qualitative survey for more depth of comment to aid in the future development of the resource guide.

Data collection for this project is currently in progress. Preliminary data will have been collected for presentation at the SITE conference in February, 1999.

Conclusion

It is hoped that preservice educators, university methods educators and other education professionals may benefit from the findings of this research. Additionally, it is hoped that, in the future, this comprehensive Internet resource can be further expanded in to further educators' goals of infusing technology into elementary and secondary classrooms, to provide enhancement of the current curricular goals of educational systems, and to promote rich and meaningful learning experiences for elementary and secondary public school students.

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Advancement of Student Technology Integration Skills through University Pre-service Coursework

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Abstract: In the United States (U.S.) there is a shortage of new teachers possessing skills to integrate technology into the classroom. The U.S. Department of Education has recognized this problem and has funded projects targeted at pre-service teacher education. This paper focuses on a technology enhanced teacher education curriculum supported by a U.S. Office of Education Preparing Tomorrow's Teachers to Use Technology (PT3) grant, which is designed to give pre-service educators the skills needed to integrate technology into their classrooms. Attitudinal measures, stages of adoption of technology and proficiency measures are addressed.

Introduction

Authorities estimate that 2,000,000 new teachers with technology integration abilities will be needed in the workforce of the United States over the next seven years, while the projected capacity of all the teacher education colleges in the nation is only half that amount (Green, 1999). Vast increases in the quantity of technology – infusing educators are needed, while the quality of good programs should continue to be improved, and greater progress toward equity in making the new teachers available to underprivileged students must be pursued as well. The Millennium Project: Pathways for Preparing Tomorrow's Teachers to Infuse Technology, is one of more than 100 projects funded in the USA by the U.S. Department of Education in pursuit of these goals.

The curriculum on which this project is based has a credible foundation, in part due to strong alignment with state and national technology standards, and in part due to the use of reliable indicators capable of showing progress toward course and standard goals. For more than a decade the Computer Education and Cognitive Systems Program in the Department of Technology and Cognition at the University of North Texas has been offering a three-course sequence that leads to curriculum/technology integration skills for graduates. For the past two years data have been gathered to assess the attitudinal changes and student perceptions of their own technology integration abilities. This paper reports on the impact of this curricular sequence.

The Curriculum

Undergraduate courses at the University of North Texas are numbered in a four-digit sequence for which the first number indicates the approximate year-level of the content and the remaining three indicate the focus of the course. In keeping with this scheme, the first course in the UNT integration sequence is

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considered a freshman-level computer applications course (1100) that is fairly standard throughout the campus, but the educational version utilizes educationally-relevant examples. The second course is a junior-level teacher productivity course (3440) while the third is a senior-level (4100) classroom/learner technology methods course. Approximately 20% of the students in the second and third course enroll in the two concurrently. Students completing the entire sequence typically enroll in the third course one or two semesters before student teaching. This three-course sequence has for more than a decade been approved for a Texas Education Agency Information Processing Technologies (IPT) endorsement which can be added to a teaching certificate.

Beginning in 1997, in order to prepare future teachers for continuous K-12 technology integration as mandated by the new Texas Essential Knowledge and Skills (TEKS) curriculum, the third course was modified to include a major module on the TEKS. Students completing this sequence were encouraged to enroll in a graduate course (CECS 5500) focusing on locating and organizing materials related to the TEKS, during their last semester as an undergraduate. An undergraduate course focusing on technology integration was formulated during this time frame as well, and is scheduled to be offered for the first time during the spring semester of 2000. Funds awarded during the fall of 1999 from a U.S. Department of Education Preparing Tomorrow's Teachers to Use Technology (PT3) grant are greatly expanding undergraduate offerings in this sequence during the 1999-2000 school year and beyond. The content of these courses is described in more detail in Table 1.

Table 1. Content for Computer Education & Cognitive Systems (CECS) Courses in Technology Applications Sequence

CECS 1100: Computer Applications in Education
This is a tool-based course in which students learn to use an integrated word processing, spreadsheet and database package.
CECS 3440: Technology and the Teacher
This course includes the use of presentation software and theories as well as the instructional design of presentation materials.
CECS 4100: Computers in the Classroom
Students in this class learn to find appropriate instructional software for the classroom, develop a multimedia project, find Internet resources for classroom use, develop a technology infused lesson plan, and make a webpage to link to their instructional resources.
CECS 4XXX or equivalent from approved list or
CECS 5500: Computer Applications for Curriculum and Instruction
Topics in this course include theories of teaching and learning, locating and organizing resources relevant to the TEKS, and developing a model curricular unit integrating technology, as a final project.

Completion of this four-course sequence entitles undergraduates to a University of North Texas certificate in curriculum and technology integration. Although this certificate currently carries no official status other than recognition by the University of North Texas, it is consistent with the needs expressed by several Texas school districts and is closely aligned with the TEKS[1].

Instrumentation

Attitude measures

Instruments developed by the authors during 1995-97 (Christensen & Knezek, 1998; Knezek & Christensen, 1998) have been successfully used to assess pre-post changes in attitudes toward information technology in pre-service course participants for several semesters. The primary instruments used have been the Teachers Attitudes Toward Computers Questionnaire (Christensen, 1997), and the Teachers' Attitudes Toward Information Technology Questionnaire (Knezek & Christensen, 1998). These two instruments collectively measure 15 constructs related to attitudes toward information technology. Subscale reliabilities for sets of educators completing the instrument have ranged from .85 to .98. Changes in pre-service educators' attitudes on selected constructs will be featured in this paper.

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[1] Currently there are no teacher preparation standards adopted by the Texas State Board of Educator Certification, to be applied by the Texas Education Agency statewide, for the Technology Applications portion of the Texas Essential Knowledge and Skills.

Stages of Adoption of Technology

Christensen (1997) developed a direct self-report measure of educator stage of adoption of technology, based on the earlier work of Russell (1995). In this instrument, respondents select one of six stages that best represents where he/she currently lies in the continuum from Awareness (Stage 1) to Creative Application to new contexts (Stage 6). This instrument has proven itself to be useful tracking advances in in-service as well as pre-service educator development over time. A recent test-retest check on the reliability of this instrument for a sample of 98 teachers in the Dallas-Ft. Worth Metroplex, yielded a reliability estimate of .96. Stage of Adoption is a primary outcome measure reported in this paper. A copy of the instrument is provided in the Appendix.

Skills Assessment

The Technology Proficiency Skills Assessment Instrument (TPSA) (Ropp, 1998) was added to the battery of instruments completed by pre-service educators in the fall of 1999. This instrument assesses educator skills related to information technology in six areas: Electronic Mail, World Wide Web Utilization, Integrated Applications, Teaching with Technology, Multimedia Skills and Web Skills.

Impact of Curricular Sequence

Stages of Adoption

Data gathered to date indicates that the curricular sequence is reasonably well articulated and results in measurable advances in stages of adoption of technology, as reported by the course participants themselves. For example, during the fall semester of 1998, participants in the first course of the sequence (CECS 1100 – Computer Applications) began on the average at stage 3.1 and exited the course on the average at stage 3.9. Students in the second course in the sequence (CECS 3440 – Teacher Productivity Tools) began on the average at stage 4.1 (posttest data was not available), while students in the third course (CECS 4100) began on the average at stage 4.4 and exited from the course at stage 5.2. This can be compared to a typical teacher, as measured by a sample of more than 1000 from the same geographic area, during the same time frame. The average rating across practicing teachers was 4.13, a value lying near the center of the indices reported across the three-course technology integration sequence. These results are graphically displayed in Figure 1.

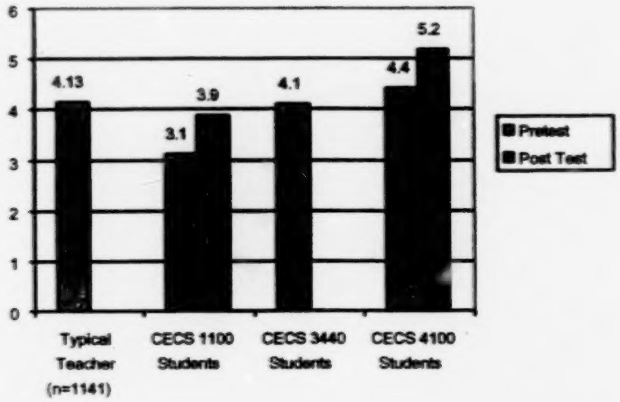

Figure 1. Stages of adoption of technology for three classes of pre-service teachers versus in-service teachers (1998).

Pre/Post Attitude Changes

Students in the third course of the sequence (CECS 4100) have in the past exhibited reduction in anxieties, the development of more positive attitudes toward technology for student learning, and more positive perceptions of technology as productivity tools. In addition, pretest data gathered from first course, second course, and third course students during the fall of 1999 indicate that the trends in attitudes for the three courses generally mirror the differences previously reported with respect to stages of adoption. Three of seven attitudinal constructs measured revealed significant differences between students in these three courses. As shown in Figure 2, students in the third of the three-course sequence were significantly higher ($p < .05$) than both other courses on F1 - Enthusiasm and F6 - Productivity.

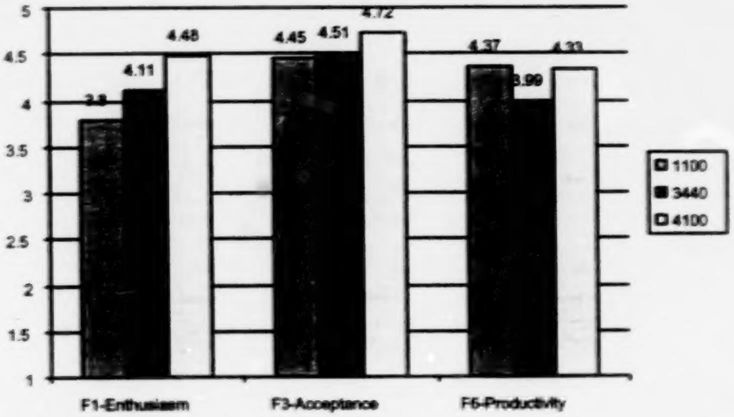

Figure 2. Fall 1999 pretest attitudinal measures for three UN T classes

Technology Skills Assessment

Data were gathered from UNT pre-service teachers using the Technology Proficiency Skills Assessment (TPSA) for the first time during the fall of 1999. Initial findings, based on one CECS 4100 class of 21 students, are graphically displayed in Figure 3. Students enrolled in the Computers in the Classroom course reported large skill gains ($p<.001$) in six major areas measured by the TPSA. The effect sizes on these gains (post-test mean - pretest mean, divided by pretest standard deviation) ranged from 1.94 to 2.29. The average gain in level of technology proficiency was approximately two standard deviations.

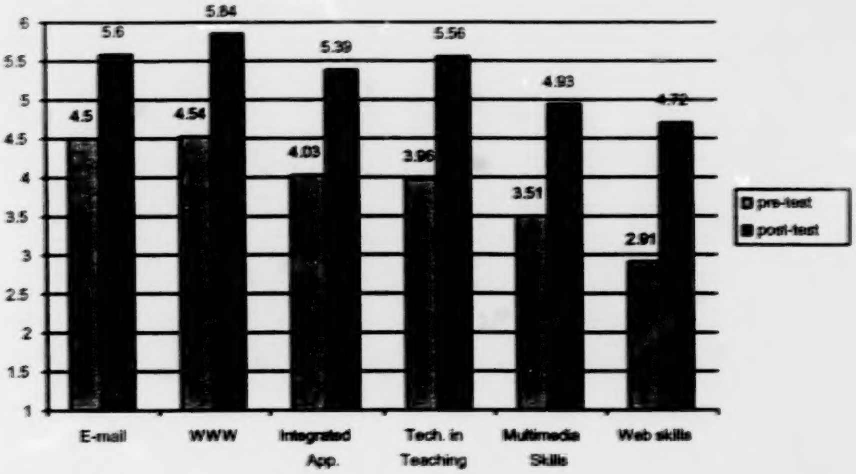

Figure 3. Pre- and posttest technology integration skills comparison for CECS 4100 pre-service students.

Texas Essential Knowledge and Skills (TEKS) Proficiency

During the spring of 1998, students enrolled in CECS 4100 – Computers in the Classroom were given an additional form that enabled them to assess their level of knowledge of the K-12 Technology Applications curriculum and the resources provided by the state of Texas to support teachers in fostering student learning. As shown in Table 3, the effect size for self-reported improvement in knowledge of the TEKS ranged from .8 to 3.7. This can be compared to effect sizes ranging from .2 to .8 for the attitudes showing significant (p = .05) positive gains for the same group.

Table 3. Fall 1998 changes in attitudes and knowledge for computers in education (CECS 4100) students

	Pretest	Post Test	Sig.	Pretest SD	Effect Size
Email (TAT)	5.73	5.94	0.05	1.07	0.20
WWW (TAT)	6.09	6.35	0.03	0.91	0.29
Multimedia (TAT)	5.53	5.99	NS	1.35	
Teacher Prod. (TAT)	6.37	6.24	NS	0.75	
Classroom Prod.(TAT)	6.57	6.41	NS	0.59	
Familiar with TA TEKS	2.00	3.62	0.0005	1.16	1.40
Confidence in integrating TA-TEKS	1.33	3.17	0.0005	0.49	3.76
TA-TEKS resources	1.13	4	0.0005	1.19	2.41
Stage of Adoption	4.36	5.23	0.0005	1.00	0.87

- Note. TA-TEKS are the Technology Applications Texas Essential Knowledge and Skills
- Note: TAT is Teachers' Attitudes Toward Information Technology Questionnaire

Discussion

Texas adopted a new curriculum in 1997 that requires the integration of technology throughout the K-12 curriculum. However, Texas has not yet settled on a new set of teacher education standards for this new curriculum. In the absence of statewide guidelines, the University of North Texas, in consultation with area schools and educational service centers, has produced a Technology Applications Curriculum Integration sequence which consists of four courses at the undergraduate level. The technology infusion emphasis gives pre-service teachers the opportunity to learn how to structure lessons, student projects, and student activities that are motivational, involve active participation, permit collaboration, emphasize content mastery, and incorporate individualized instruction. As these teachers enter their profession, they will have a unique set of skills and technology-related experiences that empower them to be adept in their

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classroom environment, plan the equitable use of technology resources, and build a dynamically networked learning community based on curricular goals.

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Appendix

Stages of Adoption of Technology[2]

Stage 1: Awareness
I am aware that technology exists but have not used it - perhaps I'm even avoiding it.

Stage 2: Learning the process
I am currently trying to learn the basics. I am often frustrated using computers. I lack confidence when using computers.

Stage 3: Understanding and application of the process
I am beginning to understand the process of using technology and can think of specific tasks in which it might be useful.

Stage 4: Familiarity and confidence
I am gaining a sense of confidence in using the computer for specific tasks. I am starting to feel comfortable using the computer.

Stage 5: Adaptation to other contexts
I think about the computer as a tool to help me and am no longer concerned about it as technology. I can use it in many applications and as an instructional aid.

Stage 6: Creative application to new contexts
I can apply what I know about technology in the classroom. I am able to use it as an instructional tool and integrate it into the curriculum.

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[2] From Christensen, R. (1997). Effect of technology integration education on the attitudes of teachers and their students. Doctoral dissertation, University of North Texas. Based on Russell, A. L. (1995). Stages in learning new technology: Naive adult email users. Computers in Education, 25(4), 173-178.

Giving Teachers the Tools They Need to Integrate Technology

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Abstract: Today, elementary teachers often are required to integrate technology in their classrooms and to teach students to utilize technology. In Pennsylvania, preservice elementary teachers typically receive one course in technology instruction. There is little or no attempt to demonstrate to these preservice teachers ways to integrate technology into their classroom assignments in education or in methods courses. It is important to give preservice teachers the training and experiences they need to make valid decisions in the use of technology as a tool for instruction. In the program described in this paper, preservice teachers first master the use of technology for their personal needs. Second, students are taught ways to evaluate software packages. Next, they have opportunities to create lesson plans that integrate technology in appropriate ways. Finally, students are given opportunities to use technology in actual classroom situations with small groups of elementary students during methods classes.

Introduction

Although computers and technology are expanding in classrooms across the nation, a study conducted by *Education Week* and reported in *The New York Times*, (September 29, 1999) concludes that teachers remain Abefuddled about how exactly to incorporate the machines into their lesson plans." Often technology is used in the classroom simply to satisfy the demands of district officials or teacher review polices. According to a study conducted by the National Education Department and cited in *The Pittsburgh Post Gazette* (January 29, 1999) and in *The New York Times* (January 29, 1999), A78 percent of teachers reported training in technology, [but only] 20 percent felt >very well prepared to use it in their classrooms.'" Weinman and Haag (1999) argue that in 1997 researchers found that Aonly 15 percent of teacher candidates nationwide had received at least nine hours of technology training." This means that while new teachers are typically unprepared for 21st century technology, educational institutions need and expect new personnel to be able to provide leadership implementing technology throughout the curriculum and district.

Dr. Arthur Wise, president of the National Council for Accreditation of Teacher Education (NCATE), argues that most schools of education do not adequately train teachers to use and integrate technology into their teaching. By the year 2000, technology will have to be integrated throughout the coursework for a college to maintain NCATE accreditation. (Rosenthal, 1999). Rosenthal (1999) cites Lynn Silver, national strategic relations manager for Apple computer, who says that, Schools of Education must ensure that our future teachers can use technology to communicate, collaborate, and support critical thinking and problem solving.

According to the Milken Exchange, the Afederal government estimates that [the United States] will need 2.2 million new teachers over the next decade to accommodate both the increase in students and the public's demand for smaller class size" (Basinger, 1999). To establish baseline data on the status of technology use in teacher-training programs, the Milken Exchange surveyed 416 teacher-preparation programs representing approximately 90,000 graduates for the 1997-98 school year. The survey results indicate that over 70% of these teacher-training programs require at least some instruction in Instructional

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Technology. The institutions that reported the highest levels of student technology skills and experiences, were Athose with no heavy computer course requirements, but those that made use of technology on a routine basis throughout the teacher training program" (Basinger, 1999).

The Milken-ISTE report cited above makes these conclusions:

1. Information-technology instruction should be integrated into all courses and SCDE activities, rather than being limited to stand-alone classes.
2. Institutions should engage in technology planning that focuses not only facilities but on the integration of information technology in teaching and learning.
3. Student teachers need more opportunities to apply information technology during field experiences under qualified supervision.
4. Faculty should be encouraged to model and integrate technology (Basinger, 1999).

Further research is needed to discover "the most effective models for learning how to integrate information technology into classroom practice" and "widespread dissemination of this new knowledge when available" (Basinger, 1999).

In a recent survey to elementary principals in Western Pennsylvania conducted by the Robert Morris College Education Department, 80% of the respondents stated that they would give special hiring preference to candidates with a professional expertise in technology. These administrators cited a need for new teachers to be proficient in evaluating and implementing technology software for computer, multimedia, and video use. For these reasons, Robert Morris College has developed an elementary education program that integrates technology into the basic education as well as the educational methods courses.

The Program

Given the opportunity by the State Department of Education to devise a new elementary education degree program, Robert Morris College (RMC) responded by incorporating technology not only through Instructional Technology courses, but by integrating technology into all education and methods courses throughout the curriculum. Table 1 lists the courses and course sequence for elementary education preservice teachers.

Freshman 1st Semester	**Sophomore 1st Semester**	**Junior 1st Semester**	**Senior 1st Semester**
CE212 Principles of Information & Computing **CO120** Communication Skills I **NS___** Science Elective **PY251** General Psychology **QS101** College Mathematics I ***Or*** **QS105** Mathematical Reasoning w/Applications	**CO220** Communication Skills III **CO221** Communication Skills IV **ED315** Educational Psychology & Practicum **PY355** Human Growth and Development ______ **Elective**	**CI310** Information Systems Applications **CM300** Instructional Media Design **EL301** Special Needs in the Elem. Classroom **EL405** Science Methods **EN275** Children's Literature ______ **Business Elective**	**ED335** Elementary Content Area Reading & Practicum **EL402** Language Arts Methods **EL404** Mathematics Methods ______ **Liberal Arts Concentration** ______ **Liberal Arts Concentration** ______ **Elective**
Freshman 2nd Semester	**Sophomore 2nd Semester**	**Junior 2nd Semester**	**Senior 2nd Semester**
CO121 Communication Skills II **EC101** Principles of	**CO230** Communication Skills V **ED310** Foundations of Education & Practicum	**EL401** Reading Methods **EL403** Social Studies Methods	**ED420** Supervised Teaching **ED421** Student Teaching Seminar

Macroeconomics **EL100** Computer Literacy for Education **FA103** Introduction to Art and Music **QS201** Mathematics for Elementary Teachers	**EL200** Electronic Media for Teachers **EL302** Life, Physical and Earth Sciences **GG201** Economic/ Cultural Geography	**HS101** American History to 1877 ***Or*** **HS102** American History-1877 to Present **SO231** Principles of Sociology ______ **Liberal Arts Concentration**	

Table 1: Course sequence for elementary education preservice teachers.

Thus, at RMC pre-service elementary education majors are required to take 15 credits of technology courses: nine from the college technology core and six from the RMC core. With this background, students are prepared to effectively use technology to teach content in specific subject areas. These technology core requirements are not intended to make technology experts of elementary majors: rather, the goal is to produce competent, confident elementary teachers who are comfortable with the use of technology as a tool when implementing successful teaching strategies. To accomplish this goal, RMC faculty used the National Education Technology Standards published by the International Society for Technology in Education as a model for designing courses and assignments. Table 2 lists the standards for grade 5 and the courses in which these standards are met.

Prior to completion of GRADE 5, students will:	**CI 212**	**EL 100**	**EL 200**	**CM 300**	**CI 310**	**Elem. Methods**
1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively. (2)	I	O	O	I	I	
2.Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide. (1, 2)	O	O		O	O	O, I
3. Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use. (2)	I	O	O	O	O	I
4. Use general-purpose productivity tools and peripherals to support personal productivity, remedial skill deficits, and facilitate learning throughout the curriculum. (3)		O	I	O	O	I
5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, and scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside		I	O	O		O, I

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the classroom. (3, 4)						
6. Use telecommunications efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests. (4)	O	I	I	I		
7. Use telecommunications and online resources (e.g., e-mail, online discussions, Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom. (4, 5)		O	I	I	O	
8. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem-solving, self-directed learning, and extended learning activities. (5, 6)		I	O	O		I
9. Determine when technology is useful and select the appropriate tools(s) and technology resources to address a variety of tasks and problems. (5, 6)		I	O	O	O	I
10. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources. (6)			I	I		I

Table 2: Standards for grade 5 and the courses in which these standards are met. *I* represents the courses where the standards is included, and *O* represents courses where the standard is an objective of the course.

The integration of technology in course assignments illustrates to preservice teachers in a concrete manner ways in which technology can and should be used as a tool for educators instead of a Aby-product.≅ Some examples of learning activities in various courses include:

- searching for appropriate Internet sites and creating hyperlinks for elementary students,
- corresponding via e-mail to elementary students,
- evaluating software packages in content areas such interactive readers,
- creating graphic organizers and data bases, using commercial packaged software such as PowerPoint™ and ClarisWorks for Teachers™,
- evaluating on line lesson plans and teacher materials,
- using scanners to integrate pictures of students' work into text and presentations,
- and evaluating video segments for use in the classroom.

Through these courses and activities, preservice teachers learn that technology is a natural extension of their lessons and can be incorporated in the classroom. More importantly, students learn the appropriateness of technology in classroom assignments. They learn when the use of technology is inappropriate as well as when the use of technology can enhance instruction.

In order to practice and present the ways they have integrated technology in their course assignments, all elementary education majors have access to presentation classrooms. These classrooms are equipped with computers, projection screens, video recorders and players, CD players, and camcorders. These students also have access to computer classrooms and labs. In addition to the presentation classrooms, these preservice teachers have access to a resource lab that is equipped with additional materials, both hardware and software. Here they are able to work on specific assignments, prepare lessons, and experiment with the technology. Elementary students, therefore, are able to demonstrate their individual use of technology in presentation situations in a variety of classes before they enter the methods classes.

Another unique feature to the RMC elementary education program is the use of area public schools and personnel to teach methods courses. Students spend part of the day in real schools with real elementary teachers and students. They are able to use the resources found in public schools to complete projects and assignments. School personnel teach method classes in the afternoons to the RMC students. Thus, RMC elementary majors benefit from instructors who are expert in translating theory into practice. They also benefit by having the opportunity to observe, for extended periods of time, real elementary classroom situations and instruction. Our public school partners benefit by having RMC elementary students who are competent in technology suggest ways that technology might be integrated into daily lessons.

Program Evaluation

Like all educational programs, evaluation of this new elementary education degree will be on going. The success of this program will be stringently evaluated in order that RMC can continue to deliver a high quality, technology-driven program that is demanded by the education community. RMC is dedicated to students, to colleagues in basic education, and to prospective elementary education students in classrooms today and in the future. RMC's intent is to provide a program that strongly prepares elementary preservice teachers to help public school elementary students embrace the technology at the elementary level and prepare them to accept the technological challenges of the intermediate level. Thus, the success of this program will be evaluated by the following five measures:

1. An Elementary Education and Technology Steering Committee of colleagues from schools surrounding our campus will help guide the program. Most of the committee members work in schools where RMC students will be placed for field experiences. Receiving continual feedback from these individuals will be instrumental in assuring progress and improvement.
2. The cooperating teachers who supervise our students during student teaching will provide the second measure.
3. The faculty who developed and who will teach in the elementary education program will evaluate their courses. Students, in these courses, will also complete an evaluation form.
4. The Education Advisory Committee will provide feedback on up-to-date issues in education and how courses at RMC are meeting the requirements that these issues demand. Two of the new four members of the committee will be elementary technology specialists.
5. A formal evaluation request will be sent to the employers of graduates asking for feedback on the success of the graduate in the performance of classroom duties and how these graduates are integrating technology in their classrooms.

"Today's students live in a global, knowledge-based age: They deserve teachers whose practice embraces the best that technology can bring to learning" (Education Digest Oct. 1999). It is the primary goal of the RMC faculty to prepare teachers who are intellectually prepared, professionally dedicated, and socially responsible and who strive to bring out these same qualities in their students. It is our philosophy that the teacher education program must enable prospective teachers to help their students grow in intellectual curiosity, self-confidence, knowledge, responsibility, and interpersonal relationships. It is our strong belief that prospective teachers must be prepared not only to capably teach in the educational programs of today, but also to build successful programs needed for the future. To achieve these objectives, it is important that students understand their roles as professional educators, to define life-long goals, and to accept the obligations associated with the achievement of professional status. In keeping with this basic philosophy, RMC has developed a technology-based elementary education degree program to fill the needs of the future.

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